UME XVI JANUARY, 1916 NUMBER 1

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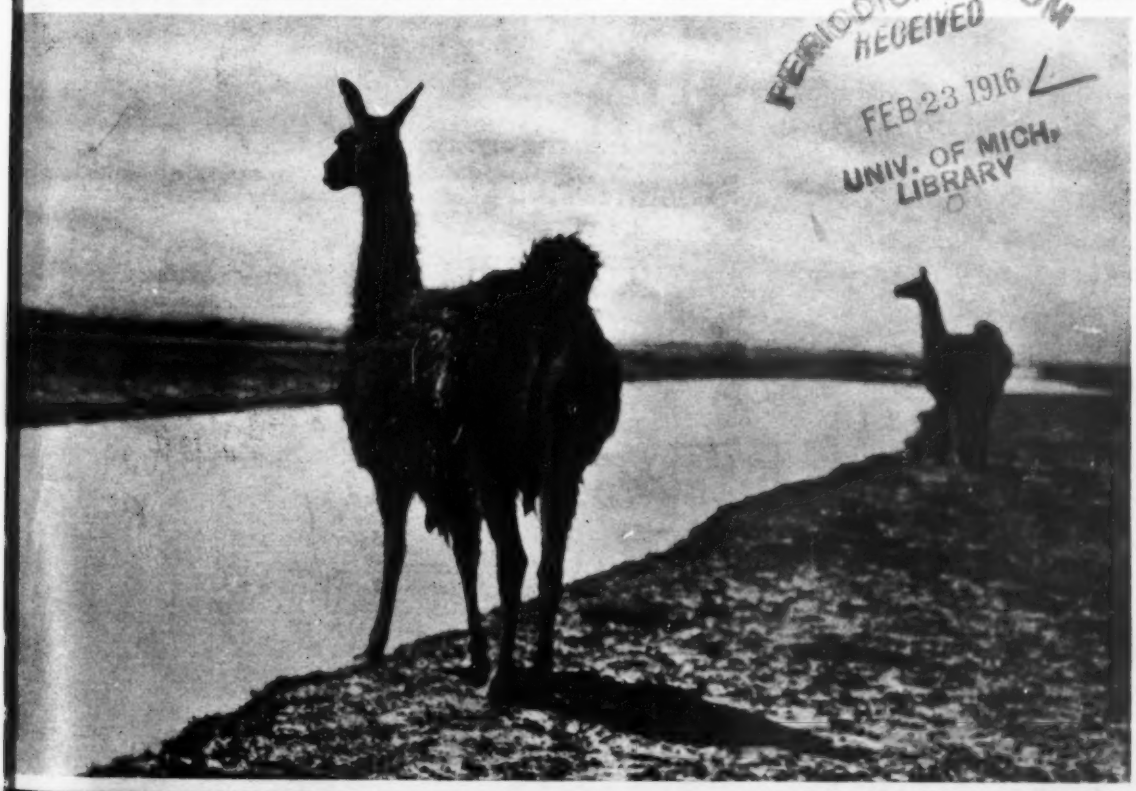

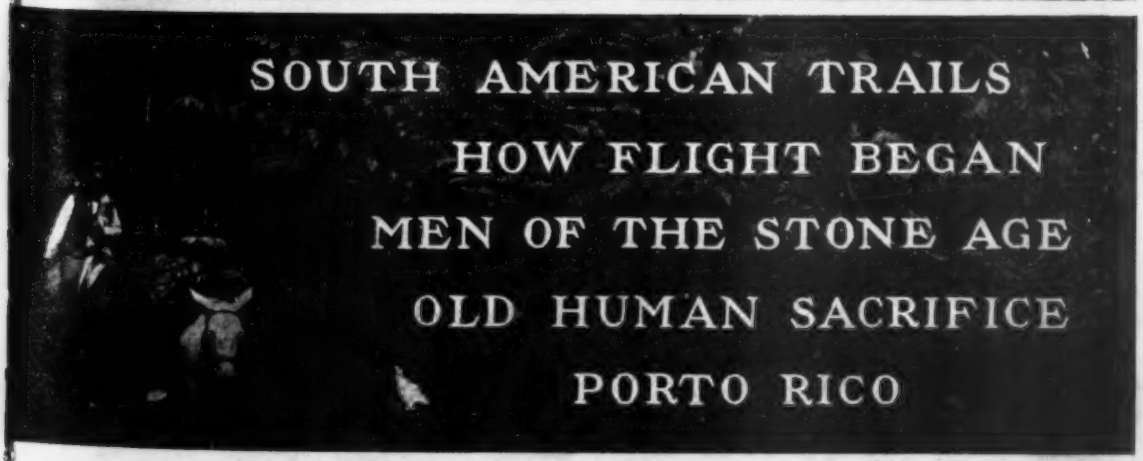

SOUTH AMERICAN TRAILS

HOW FLIGHT BEGAN

MEN OF THE STONE AGE

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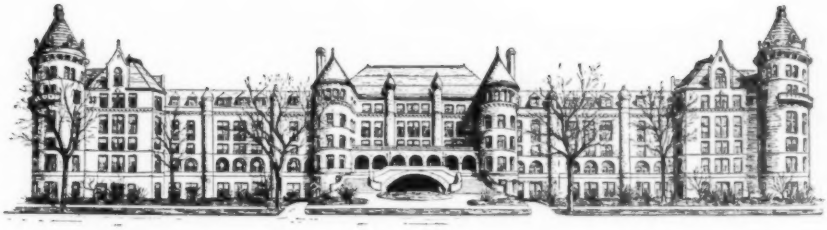

THE AMERICAN MUSEUM JOURNAL

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January, 1916

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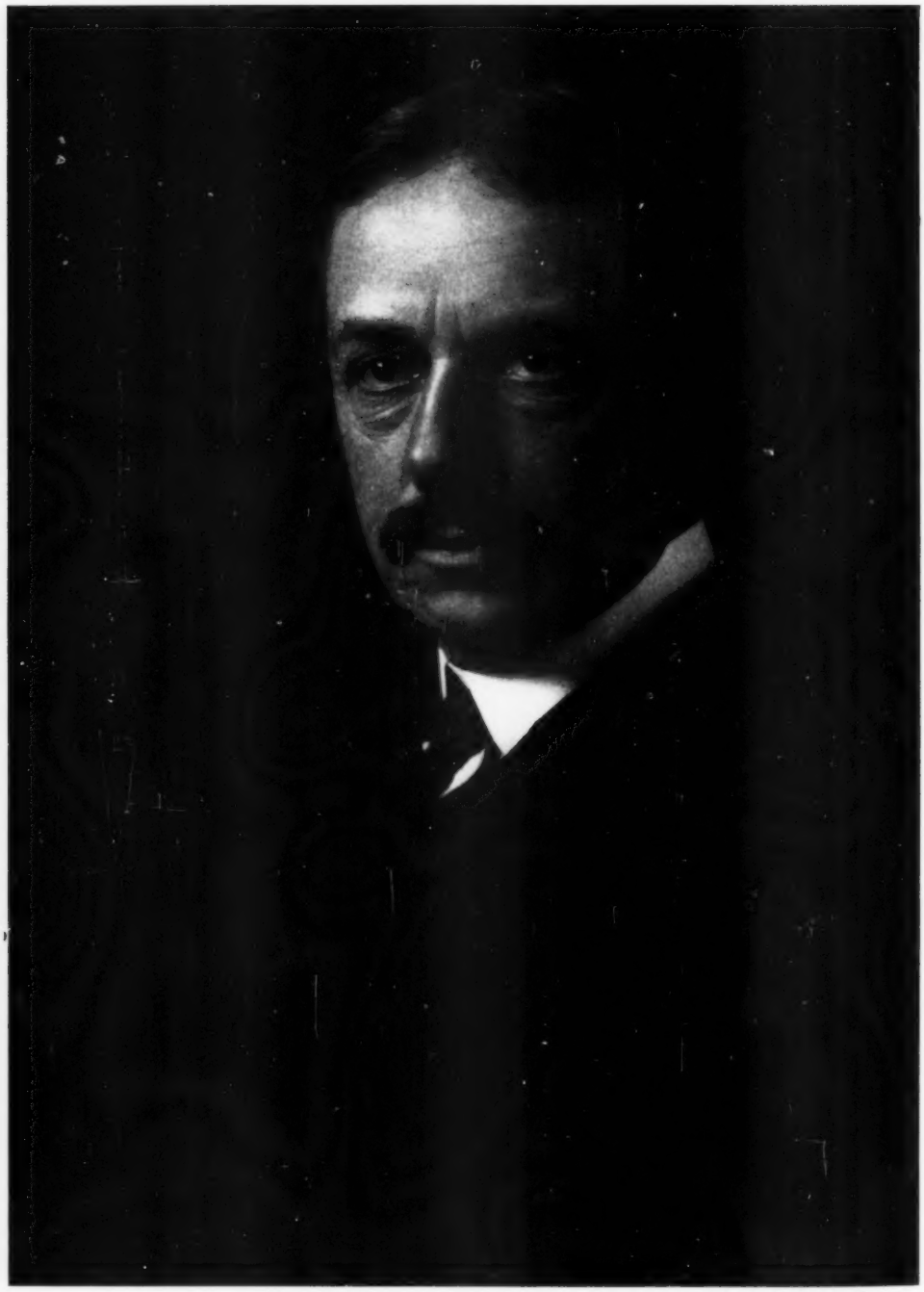

Photo by Fowler, Evanston

PROFESSOR HENRY FAIRFIELD OSBORN

Author of a recent book on the extinct ancestors of man, *Men of the Old Stone Age*, published by Charles Scribner's Sons; Da Costa professor of zoölogy in Columbia University, Curator Emeritus of vertebrate palæontology and President of the Board of Trustees in the American Museum of Natural History

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THE AMERICAN MUSEUM JOURNAL

VOLUME XVI JANUARY, 1916 NUMBER 1

The Beginnings of Flight

By FREDERIC A. LUCAS

THE recent recognition by Mr. C. William Beebe, curator of birds at the New York Zoölogical Park, of certain feathers on the hind legs of the young of modern birds,[1] which according to his view may have served the purpose of wings in ancestral birds, brings up anew that ever fascinating problem, "How did flight begin?" and this in turn is inseparably connected with that other problem, "How did birds begin?"[2]

The answer to this latter query is seemingly as far off as it was fifty-four years ago when the first *Archæopteryx* came to light in the famous quarries of Solenhofen. We are pretty sure that birds branched off from reptiles, fairly sure that they must have started as far back as in the Trias or even Permian, when the curious anomodonts faintly foreshadowed the coming mammals. But just what form gave rise to birds we know not; we have not even any living bird that shows such strong traces of reptilian origin as do the monotremes among mammals.

Like Mr. W. P. Pycraft, Mr. W. DeW. Miller and the writer, there are some even so heterodox as to believe more or less firmly that possibly birds had not one, but two points of origin, and to feel that if we could follow back their lines of descent we should find that the ostriches came from one, and the birds of flight from another. And why not? Is it any more strange that Nature should have repeated herself once than that all our birds should have been derived from one pair of ancestors?

Such heretics — and a heretic is merely one who differs from the majority — such heretics as believe in this so-called "diphylletic" origin of birds cannot help propounding the queries, "Is the ostrich big because he doesn't fly?" or "Doesn't he fly because he is big?" or "Did he never fly at all?" Those who bring forward the ever-ready fact that the embryology of the ostriches seems to indicate that they are descended from forms that flew, are reminded that embryology is not regarded as so decisive in its testimony as it was fifty years ago.

We are all familiar with the ready argument that such extraordinary structures as feathers could not have been developed twice, but this is not a whit more strange than that they should have

[1] "The Tetrapteryx Stage in the Ancestry of Birds," by C. William Beebe, curator of birds, the New York Zoölogical Park. Published in *Zoologica*, Vol. II, No. 2, 1915.

[2] Fifteen million years ago, in the middle of the Palæozoic or second great period of the earth's history, the Age of Fishes was just drawing to a close. The only vertebrate animals that could live upon land were the primitive, froglike batrachians, and even these were probably much more at home in the water.

We have no record of the myriad different types of creatures that succeeded these first dwellers on the land, except their fossil remains found buried in the rocks of the various geologic ages, and this record is far from complete. Hence, although we believe that the higher vertebrates — reptiles, birds and mammals — are derived from the slow-crawling, cold-blooded, small-brained primitive batrachian, it is not possible to trace the successive stages of the descent.

By courtesy of the New York Zoölogical Society

A POSSIBLE ANCESTOR OF MODERN BIRDS

This drawing of the Tetrapteryx stage in the ancestry of birds is based on characters in *Archæopteryx* and in the young of modern birds. There are two principal theories as to the origin of flight, one that it was brought about by jumping up, the other by jumping down or volplaning from trees as does the flying squirrel among mammals today

By courtesy of the New York Zoölogical Society

White-winged dove four days old, with wing and leg extended, the latter to show the feathers of the "pelvic wing"

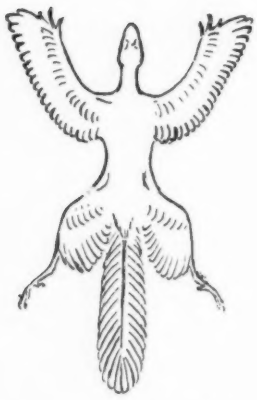
been developed at all, and we are as much in the dark as ever regarding the manner of this. *Archæopteryx* is very reptile-like; but for its feathers it might be a reptile, and so far there is not the slightest hint of an intermediate stage between scale and feather.

But to come back to the question of flight: there are two principal theories as to its origin, one that it was brought about by jumping up, the other that it was brought about by jumping down. According to one view, the about-to-be birds ran along the ground, or jumped into the air waving their fore limbs vigorously, until the time came when the wings were sufficiently developed to raise their owner into the air. Those who hold the other view consider that flight began by animals leaping from trees and instinctively spreading their limbs to catch at anything convenient to break their fall.

Advocates of the first theory cannot bring forward a single creature that today habitually runs along the ground before taking flight; the best they can do is to adduce the flying fish which is not

By courtesy of the New York Zoölogical Society

"Pelvic wing" of the squab of the white-winged dove, consisting of twelve flight feathers and six coverts. These feathers develop on the young bird while the body is yet bare except for the flight feathers of wing and tail



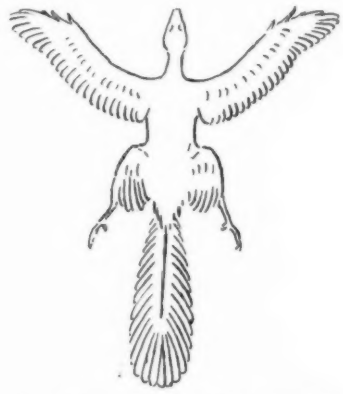
Tetrapteryx stage, when the "pelvic wing" of birds was at its height of development and use

to the point at all, especially since a large number of observers say that the flying fish does *not* fly, although in this we believe them mistaken.

Those who favor the jumping down theory, as opposed to the jumping up, can on the contrary show almost every stage in the progress from flightlessness to flight, beginning with lizards that, like the iguana, jump boldly from their abiding places on the branches, to the flying lemur that can sail — or parachute — for a hundred yards or more. Even snakes that drop from trees have developed — or there has been developed in them — an ability to hollow in the under side of the body, which affords some slight resistance to the air. Not only this, but true flight has also been developed in three classes of vertebrates: reptiles, birds and mammals, in the order of their appearance in time; and if it failed to develop in fishes and amphibians, it may well be ascribed to the fact that neither of these groups were tree climbers and when tree frogs did appear they were too highly specialized to make a success of flight.

As to fishes, they were handicapped by the structure of their fore limbs, and although representatives of several orders have essayed to fly, only two groups, the Characinidæ and Exocoetidæ, have met with any measure of success — and many people aver that neither of these really fly.

Also it is worthy of note that none of the flying or sailing animals use the hind legs actively; bats, flying squirrels, even flying fish, simply use the hind limbs as adjuncts to flight, holding them motionless to spread a membrane or



Archæopteryx stage, when the wings were increasing in power and the "pelvic wing" was going into disuse

form a kitelike support for the hinder end of the body. The hind legs are used to jump with, not to run with, save in sea birds that, like the albatross in a calm, may run a quarter of a mile before getting headway enough to launch himself into the air. But where would a lizard get a good straight away level stretch?

The new evidence that Mr. Beebe brings forward to show that flight began by sailing, consists of a series of sprouting quills, found in newly hatched birds of several species, running from the outer, upper part of the leg just below the knee, nearly to the base of the tail. These quills are placed just where, if developed, they would form a sort of winglet on either side, which combined with the tail would afford excellent support for the hind part of the body during

flight. Just such tufts of feathers are known to have occurred in *Archæopteryx* (Berlin specimen), and Mr. Beebe concludes that, like the back fins of the flying fish, they served to support the hinder part of the body as the creature sailed — or as our English cousins prefer to put it — parachuted through the air. For Mr. Beebe doubts that even *Archæopteryx* was capable of true flight, believing that the fore limbs, like the hind, were rigidly extended at right angles to the body and not flapped.

A most striking bit of evidence is the fact that just as overlapping coverts are found above the secondaries of the bird's wing and alternately with them, so the bristle-like quills on the thigh of the pigeon are surmounted by a series of quills placed precisely like the wing coverts.

A later stage when there has begun a shortening of the tail and concentration of the tail feathers

The value of any character or piece of evidence does not lie in its size but in its constancy, or in its apparent relation to other characters, so these little bristle-like feathers of the nestling dove, according to Mr. Beebe, hint at a time when, as just noted, they served a useful purpose and were sufficiently developed to support, or help support, the hinder portion of the body. At this stage in the development of birds, which should be somewhere near the lower Jurassic, about seven million years ago, both fore and hind limbs bore feathers; but neither pair of limbs took an active part in aërial locomotion, their function being that of planes, purely passive. This phase of the development Mr. Beebe terms the *Tetrapteryx* or four-winged stage. At this stage, to quote from Mr. Beebe, "flight was merely gliding, the fingers were too free, the arm bones too delicate, the sternum small or absent, and these facts considered in connection with the small, weak pelvis, make it impossible to picture the creature as flying skillfully about. In succeeding generations the pelvic wings would become more and more reduced. Having arisen from among the surrounding scales, they had for a time volplaned through the air of early ages, a structure passive and, as future centuries would show, of merely transitory function. Yet they were of tremendous importance in allowing the pectoral scales to develop, to become feathers, and then to assume an importance which was to make the class of birds supreme in the air. Yet the function of the pelvic wings had been so passive and negative that no special muscling had been necessary, no increase or coalescence of bony

The bird as we know it today, with no trace of the "pelvic wing" except in the very young bird. Diagrams reproduced through courtesy of the New York Zoölogical Society

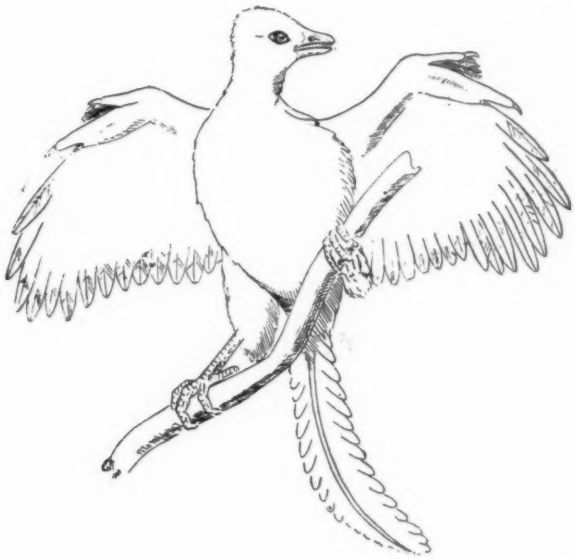
BERLIN SPECIMEN OF FOSSIL ARCHÆOPTERYX, THE EARLIEST BIRD KNOWN

The feathers on wings and tail are observed at once but those on the hind leg are not noticeable unless attention is called to them. Authorities in the past have thought that these leg feathers functioned little in flight

tissue. Little by little the line of feathers and their coverts sank into insignificance and became lost among the body plumage. It affords an excellent example of what Professor Henry F. Osborn would call the phylogenetic acceleration of a character, followed by its gradual reduction.

Millions of years after they were of use, the feathers of the pelvic wing are still reproduced in embryo and nestling. And for some unknown reason, Nature makes each squab pass through this *Tetrapteryx* stage. The line of feathers along the leg of the young bird reproduces in this diminutive, useless way the glory that once was theirs. No fossil bird of the ages prior to *Archæopteryx* may come to light, but the memory of *Tetrapteryx* lingers in every dove-cote."

Thus were scaly, creeping reptiles, transformed into feathered, flying birds, the more marked stages in the process being indicated in the accompanying diagrammatic figures which, with the cut of *Tetrapteryx* have been kindly loaned to the JOURNAL by the New York Zoölogical Society.



Restoration of Archæopteryx
After W. P. Pycraft

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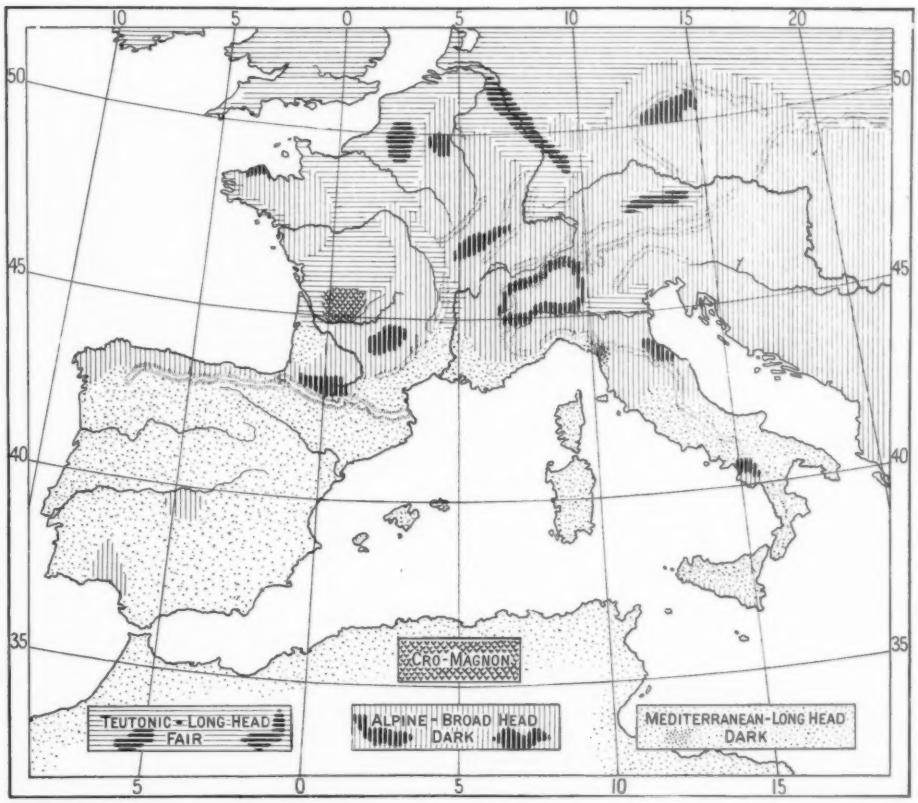
CRÔ–MAGNON MEN OF WESTERN EUROPE

In the cavern of Font-de-Gaume, Dordogne. Prehistoric men restored in the act of drawing the outlines of one of the bisons on the wall of the *Galerie des Fresques*

Drawn by Mr. Charles R. Knight, under the direction of the author



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Distribution of three principal cranial types of man in Western Europe today; also location of the supposed descendants of the disharmonic type of the Crô-Magnons [Fig. 268, p. 499, *Men of the Old Stone Age*]

"Men of the Old Stone Age"—A Review

By CLARK WISSLER

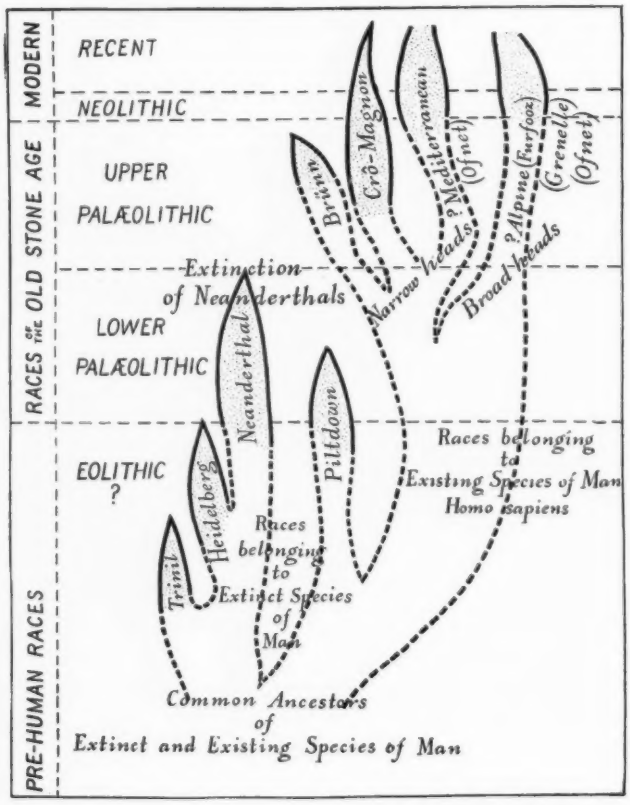
THIS new book[1] by Professor Henry Fairfield Osborn gives us the essential facts needed to comprehend the natural history of Europe in its relation to man. Such a coördination of the leading sciences cannot fail to be stimulating from every angle and forms a book which everyone can take up with the assurance of full return. Each specialist could write a review of its contents from his own vantage ground without fear of trespassing upon others, but we shall in this instance direct our attention to prehistoric man himself. Europe being for most of us the ancestral home, the phrase "Men of the Old Stone Age" at once raises the question as to their relation to us. Knowing that our culture is the accumulation of ages, can it after all be that we have some heritage from this remote age? Perhaps the following

[1] MEN OF THE OLD STONE AGE, Their Environment, Life and Art. By Henry Fairfield Osborn. 8vo., pp. XXVI + 545, 8 plates, 268 figs. and map of Palæolithic tour. Charles Scribner's Sons, New York, 1915.

striking paragraph from William James is literally true:

"Bone of our bone, and flesh of our flesh, are these half-brutish prehistoric brothers. Girdled about with the immense darkness of this mysterious universe even as we are, they were born and died, suffered and struggled. Given over to fearful crime and passion, plunged in the blackest ignorance, preyed upon by hideous and grotesque delusions, yet steadfastly serving the profoundest of ideals in their fixed faith that existence in any form is better than non-existence, they ever rescued triumphantly from the jaws of ever-imminent destruction the torch of life which, thanks to them, now lights the world for us. How small, indeed, seem individual distinctions when we look back on these overwhelming numbers of human beings panting and straining under the pressure of that vital want! And how inessential in the eyes of God must be the small surplus of the individual's merit, swamped as it is in the vast ocean of the common merit of mankind, dumbly and undauntedly doing the fundamental duty, and living the heroic life! We grow humble and reverent as we contemplate the prodigious spectacle."

As to what manner of men these were, we are no longer entirely in the dark and Professor Osborn's book sums up the case for us in a plain untechnical way. A serviceable diagram shows at a glance (Fig. 262, page 491) the assumed zoölogical relations of the known types of early man. Here the reader may see clearly the grouping into extinct forms and into those not widely divergent from the man of today. Of the former, four types are recognized, Trinil, Heidelberg, Neanderthal and Piltdown. In each case the type specimens are characterized and well illustrated. An unusual feature of the book is the finely modeled restoration of each type by Dr. J. H. McGregor of Columbia University. By carefully overlaying these ancient skulls with clay



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To show the assumed zoölogical relations of the known types of early man [Fig. 262, p. 491, *Men of the Old Stone Age*]

of a thickness corresponding to averages for the soft tissues of modern men, the approximate contour of the face is obtained. Thus we may form an idea of about how these men would appear in life.

The discussion of the Piltdown type, the most recent find, deserves notice, for our author does not accept the chronological determinations of the leading English scientists who place it in early Pleistocene times, but regards it as clearly late Pleistocene. The probability of this has been greatly increased by the recent discovery of Dr. Gerrit S. Miller, an American scientist, that the jaw found with the Piltdown skull is not human. Discarding this jaw we have a skullcap that promises to be that of a more advanced man. Had this discovery been available at the time of writing, our author could have made his case stronger.

This brings us to an important general conclusion in the book, viz., that no acceptable evidences of man as such occur before the Pleistocene. This conclusion is in opposition to the views of some distinguished European scientists but is fully supported by faunistic and other correlated data. Reference should be made to the very important correlation chart on page 41 showing the geological climatic, and faunistic associations with the successive forms of man.

This chart shows us that the most modern types of ancient men come upon the scene at the close of the last period of glaciation. The most distinctive of these was the Crô-Magnon, which we see from the restoration would pass among us today with little comment. In fact, many celebrated anthropologists believe that the blood of this race still flows in the veins of the French of the Dordogne district and elsewhere. However this may be, some of the most distinctive facial characters of the Crô-Magnon type are still to be found in parts of Europe. These old Crô-Magnons were a fine race, rather taller and somewhat larger of brain than modern Europeans.

The author emphasizes the point that it is coincident with the appearance of the Crô-Magnons that the great development of the most distinctive Palæolithic culture appears in Europe. The two great periods were the Aurignacian and the Magdalenian, each characterized by a more or less individualized art.

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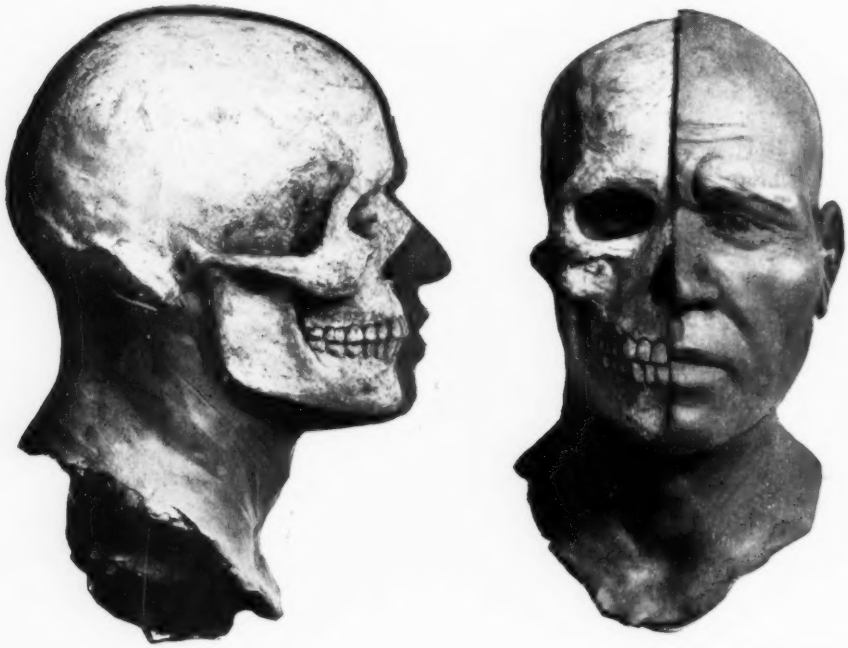
The ape-man of Java (*Pithecanthropus erectus*). Antiquity estimated at 500,000 years. It is not improbable that the prehuman races of this remote geologic age used more than one natural weapon of wood or stone

After the restoration by Dr. J. H. McGregor

Since these Crô-Magnon men may in part be our ancestors, we should like to know whence they came and in what manner they faded away or were engulfed. To these pertinent questions no very clear answers can be given. There is no reason to believe that the race came into being on the spot. No part of Europe is considered the ancestral home of any known type of man, but all



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Head of the "Old Man of Crô-Magnon" (rejuvenated by the restoration of the teeth), showing the method of restoration adopted in the models by Dr. J. H. McGregor. By carefully overlaying these ancient skulls with clay of a thickness corresponding to averages for the soft tissues of modern men, the approximate appearance of these men in life is obtained

are assumed to have been dispersed from some center in Asia. So far as the Crô-Magnons have racial affinities elsewhere, we find them in Asia and the extreme north of America.

Our author notes their slight anatomical similarity to the Eskimo but does not discuss the point further. It may be permissible to digress slightly at this point because the striking parallel between Magdalenian culture and that of the Eskimo has attracted the attention of many students. Notwithstanding the fact that in midwinter the Eskimo live upon mammals of the sea, their culture is essentially a caribou or reindeer culture. This they have in common with the Siberians and the Lapps. Their bone needles, barbed points, and harpoons are in many cases startlingly like those of the Magdalenians. Even the celebrated *bâton de commandement* seems to have its counterpart among the Eskimo where it is a homely implement. Also the undoubted artistic genius of the Eskimo has been cited. While many of the speculations upon this Eskimo parallel are fanciful, it must be considered significant that we have associated with the reindeer of both the Old and

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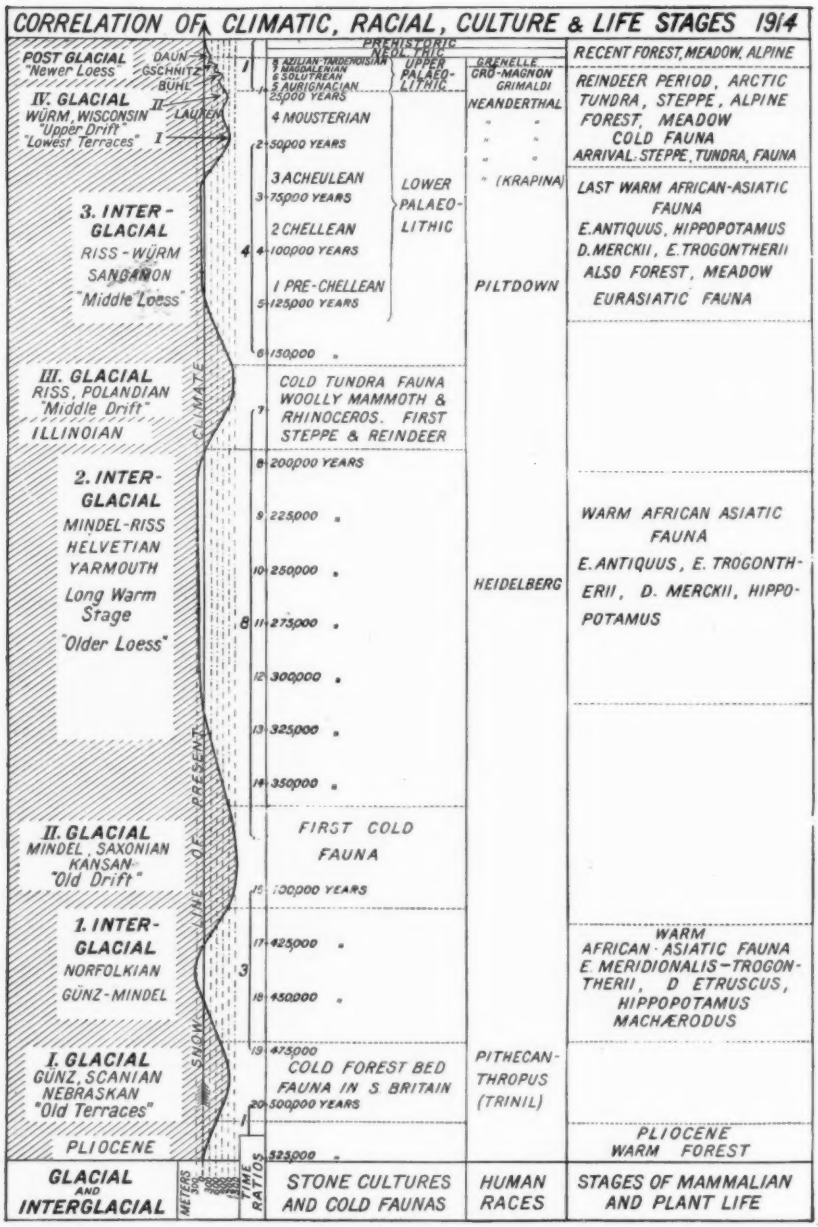
THE PILTDOWN MAN OF ENGLAND

Antiquity variously estimated at 100,000 to 300,000 years. The apelike structure of the jaw does not prevent the expression of a considerable degree of intelligence in the face. (This latter sentence to be found under the corresponding illustration in Prof. Osborn's book is of interest in the light of a discovery made by Dr. Gerrit S. Miller of Washington since the publication of the book — namely, that the jaw discovered with the Piltdown skull is ape instead of human. This leaves a skullcap of a more advanced man.) Prof. Osborn places the Piltdown man in late Pleistocene times. He concludes that there are no acceptable evidences of man as such before the Pleistocene



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GREAT EVENTS OF THE GLACIAL EPOCH

To the left the relation of glacial and interglacial stages in Europe and North America, with the author's theory regarding the divisions of time, the beginning of the Old Stone Age, and the successive appearance in Europe of different branches of the human race.

To the right the prolonged warm temperate period in Europe in the non-glaciated regions, followed by the relatively brief cold period during the past 70,000 years [From p. 41, *Men of the Old Stone Age*]

Chart prepared by Dr. C. A. Reeds of the American Museum, in coöperation with the author

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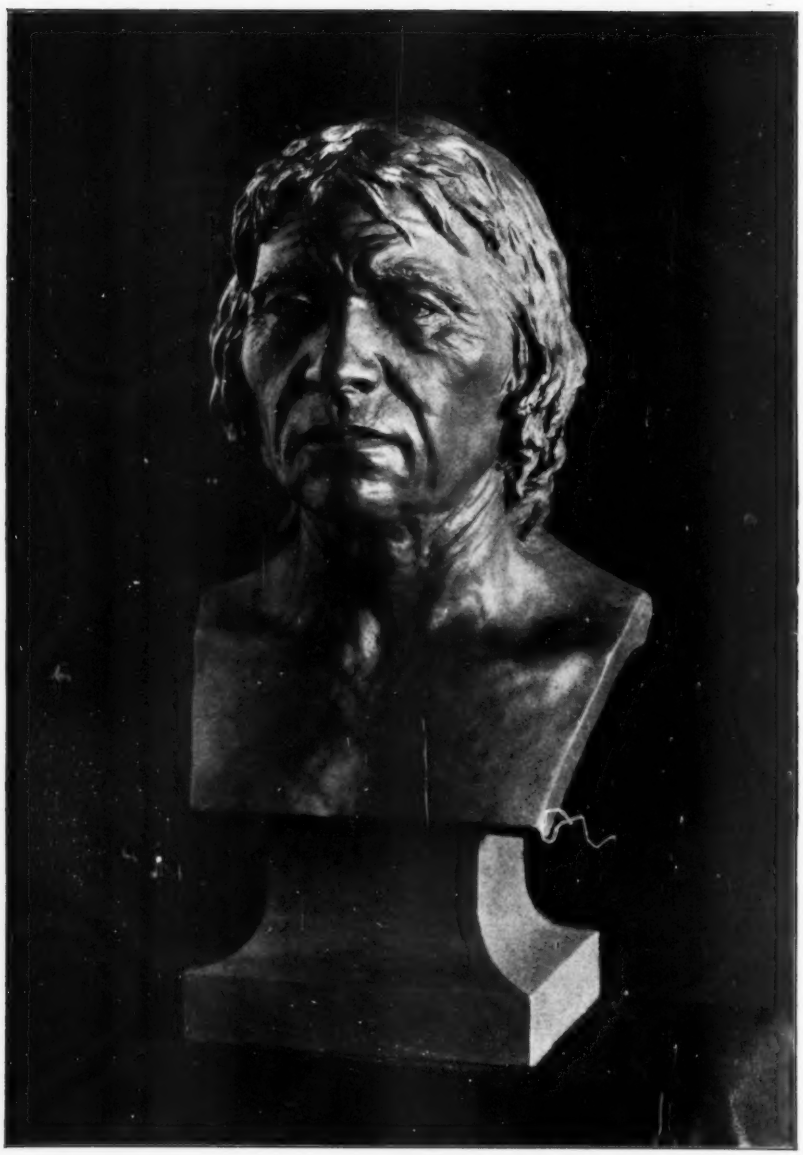
NEANDERTHAL MAN OF CENTRAL FRANCE

Antiquity estimated as between 40,000 and 25,000 years. The author does not consider that this race developed into any other races, or in fact that Western Europe was ever a center of evolution for new types of men. It is in Asia that archæological traces of the ancestors of the types of Western Europe await the investigator

After the restoration modeled by Dr. J. H. McGregor



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CRÔ-MAGNON TYPE OF PREHISTORIC MAN

This type of man would pass among us today with little comment, in fact some of the most distinctive facial characters of the Crô-Magnon type are still to be found in parts of Europe. Antiquity in Western Europe estimated as at least 25,000 years

After restoration modeled by Dr. J. H. McGregor

the New World a sufficient number of culture traits to distinguish a modern reindeer culture period. If the association between certain traits and the reindeer is so strong as to carry the former over the range of the latter, it would not be unreasonable to expect that some of the Magdalenian culture did follow the reindeer down through all these many centuries. One of the assigned causes for Magdalenian decline and the retirement of the Crô-Magnons is the retreat of the reindeer before the encroaching forestation of Western Europe. It is certain that the reindeer culture of the Magdalenians would vanish from Europe with the animal, but it is almost equally certain that it would to some extent follow the migrating fauna to other regions. Archæological research in Asia will finally solve this problem.

Returning to the book before us we see that previous to the dawn of the Neolithic which followed the Palæolithic or Old Stone Age, at least four other varieties of men came into Western Europe and laid the foundations of the present population. (These are enumerated in the Table on page 500.) Throughout the discussion it is made plain that in the Stone Age we are dealing with a culture rather than with a race, for many varieties of man came upon the scene and vanished, while the culture waves rose and fell in what appears to be their own time. The one striking culture coincident with the appearance of the Crô-Magnons has been noted, but other racial variants playing important parts came in before the close of the period. To quote our author:

"All these steps indicate the possession of certain *generic* faculties of mind similar to our own. That this mind of the Upper Palæolithic races was of a kind capable of a high degree of education we entertain no doubt whatever, because of the very advanced order of brain which is developed in the higher members of these ancient races; in fact, it may fairly be assumed from experiences in the education of existing races of much lower brain capacity, such as the Eskimo or Fuegian. The emergence of such a mind from the mode of life of the Old Stone Age is one of the greatest mysteries of psychology and of history."

The author regards the Crô-Magnon, Brünn and other human types of the Upper Palæolithic Period (p. 491) as collaterals of the same ancestral stem and not as having been evolved one from the other. Neither does he consider that the Neanderthal, Heidelberg, etc., developed into other races. There is no good evidence that Western Europe was ever a center of human evolution for new types of men. It was by position doomed to be a marginal area into which rolled successive waves of human life fully differentiated elsewhere. Then he concludes, "We may therefore imagine that the family tree of the races of the Old Stone Age consisted of a number of separate branches, which had been completely formed in the great Eurasiatic continent, a land mass infinitely larger and more capable of producing a variety of races than the diminutive peninsular area of Western Europe."

It would follow then that the Crô-Magnon mind came into being somewhere in the East and may perhaps have left its archæological traces in Asia, where they await the future investigator.

This sketch can but inadequately present even this one aspect of Professor Osborn's many-sided and timely work. The general reader can turn to it again and again for new suggestions. Perhaps no other scientific subject can so deeply stir the imagination as the one hundred thousand years of man's continuous history in Western Europe.

WORKING THEIR WAY ACROSS A DANGEROUS SLIDE THAT HAD OBLITERATED THE PATH

South American Trails

By LEE GARNETT DAY

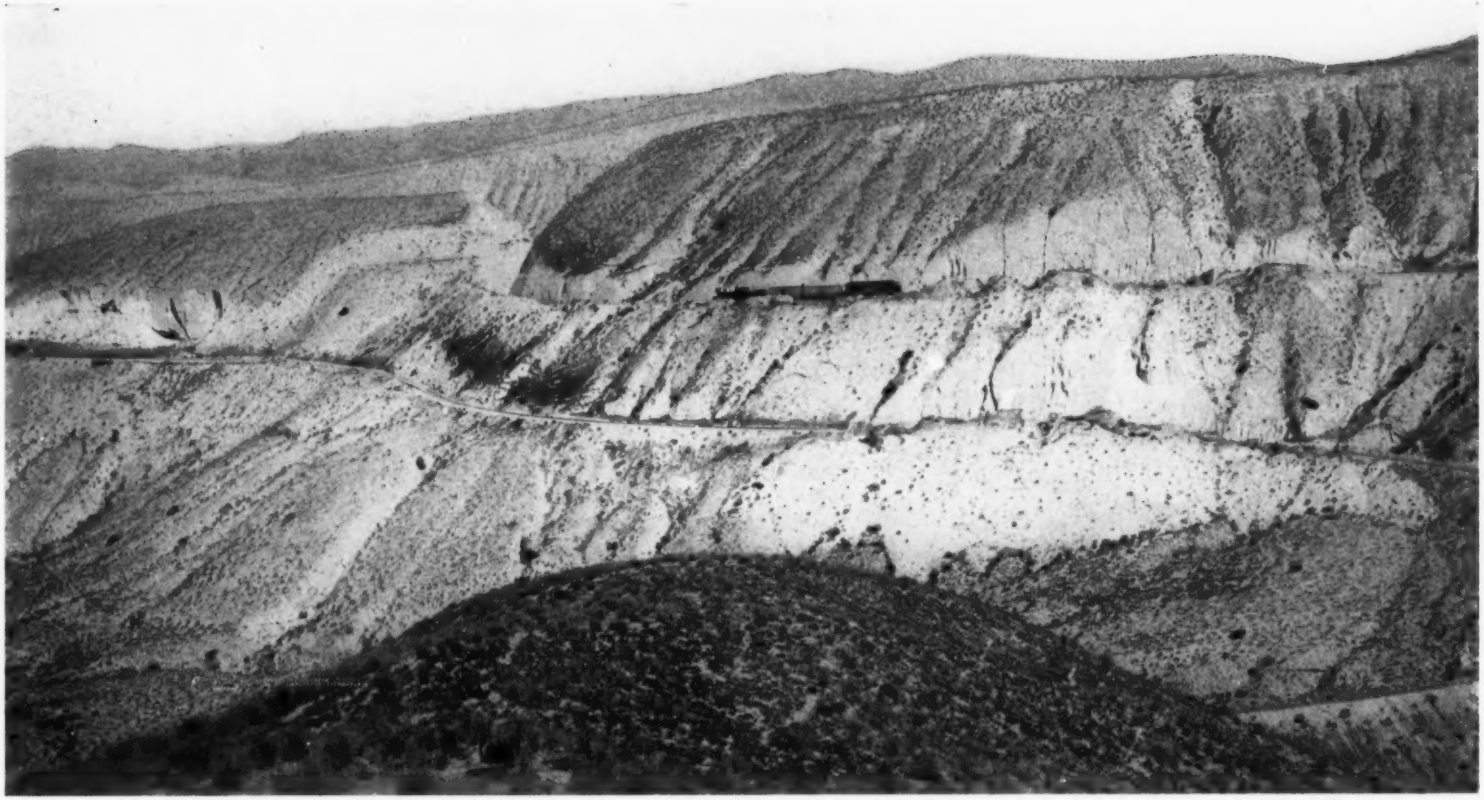
Illustrations from photographs by members of the Collins-Day South American Expedition, 1915

PROBABLY no place in the world gives the traveler more contrasts in trail, scenery and climate than do the Andes in the last range of the Cordillera. From the barren snow line at the ridge down to the headwaters of the great Amazon system is but a few hundred miles, yet in this distance four distinct changes in the fauna and flora are apparent. Starting over a hard open road where we made eighteen or twenty miles a day, the trail winds down through a rolling country until the last pass is crossed and the first signs of tropical vegetation appear. Then through the mountains of the Yungas the route lies over forested hill and dale or along narrow-ledge trails, and eventually reaches lower planes where the freshets turn into narrow streams and the streams at last into rivers. Here amidst the most abundant tropical growth, the paths underfoot more often resembled swamps than terra firma and five or six miles were considered a good day's work. In fact the stream beds often proved better trails than the machete-cut roads through the palm and cane brakes.

Crossing South America from Mollendo on the west coast to Pará on the east, by far the most eventful part of the journey is the five hundred miles by mule train from Cochabamba, high in the Cordillera, to Todos Santos, the headwaters of the Amazon, thirty-four hundred miles above its mouth. Cochabamba itself is a city of sixty thousand inhabitants, the greater number of whom have never left its suburbs. A railroad is in course of construction, but from Arque, the end of the rails, all commerce must pass by mule pack for two days over the boulders of the river bed. We reached Cochabamba from Mollendo by rail, lake steamer and coach. After crossing the first two ranges of the Cordillera by rail, we ascended the third by pack train[1] starting from Cochabamba. Our party consisted of Messrs. Alfred Collins, Willard Walker, George K. Cherrie, Robert Becker and the writer; and after securing twenty-eight mules, a chief *arriero* or mule driver, and two Indian helpers, we started for the head of the pass and the tributaries of the great Amazon River beyond.

The mule trail from Cochabamba to Todos Santos is far from an easy one to follow, notwithstanding that it is constantly traveled, being the route for most of the commerce between the low hot grazing lands of Bolivia at the eastern base of the Andes, and the high well-populated table-lands around La Paz, Cochabamba, Oruro and other cities. It is always very narrow, passes through heavy woods, over ridges, along sides of cliffs, up or down a stream, and is often difficult even to locate. Especially is this true in the rainy season when pools of mud and tangled roots encumber the way in the woods and mule

[1] The most convenient unit of baggage for transportation of this kind is a small fiber trunk or case holding eighty pounds. Two trunks made a perfect pack for the animals, compact, easy to cinch and of proper balance. At any time during the rainy season all instruments, food and clothing must be packed in bags impervious to moisture. The constant and daily rain — not to mention frequent wettings from crossing deep fords and mountain freshets — soon rusts arms and penetrates film packs. Our moving-picture camera was enclosed in three separate water-proof containers and the films protected by paraffined tin cases.



SANDY WASTES IN BOLIVIA

Wind erosion on the barren hills along the line of the Oruro Cochabamba Railway. Such barren sandy territory is found not only here in Bolivia between the western and central ranges of the Andes, but also extends along the western coast through Equador, Peru and Chile

START OF THE PACK TRAIN FOR COCHABAMBA

Adjusting the packs. The photograph shows the method of blindfolding the pack animals so that they will stand still during the operation of loading

Along a flooded portion of the Madiera Mamoré Railway when trains were not running and the expedition transported its equipment and supplies on hand cars

drivers passing previously have often left the path in search of better going, thus making false trails unsafe to follow unless with a very experienced guide.

The short journey up from Cochabamba was hot and dry, over trails covered with white dust, but the last divide we crossed in a thick mist and turning due north from the Santa Cruz trail, seemed suddenly to have entered another country. Almost perpetual rain was now encountered, and the precipitous nature of the descent, about five thousand feet in twenty-four hours, made traveling decidedly uneasy and in parts dangerous, due to the paths being water courses from which all mould had been washed away. Wet slippery rocks and often quantities of loose small boulders, made it necessary to walk most of the

Where the trail led over the bed of a dry stream and the mules continually slipped on the loose stones

way, as the slipping of a mule on the steep incline might be fatal to both rider and animal.

At Sal-si-puede ("get out if you can") — there were many places to which this name was applicable — we had to dig or cut out a track along the face of a cliff where a slide had occurred, to make room for the pack animals to pass. This was not only difficult to do on account of the steep decline and precarious footing; but also the work had to be very well done because if the pack of a mule should catch against the side of the cliff in transit the animal would be tipped over into the river Espirito Santo a thousand feet below.

From Sal-si-puede onward the mules waded streams, floundered through mud to their middles and labored over fallen logs, often on a trail so narrow and so overgrown that it was necessary constantly to use the machete to clear the path of hanging vines and dense undergrowth. On one occasion after eight hours of scrambling and wading through mud and water, Mr. Cherrie's mule slipped in a deep pool of thin mud and became tangled in the roots at the bottom, pinning the foot of the rider under it. Mr. Cherrie was held here deep in the mud until two mule drivers could return to extricate him. The advantage of having compact units of baggage was made evident in this locality. The jamming of baggage between saplings or in a washed-out gully would necessitate a halt and while the load on the mule that had caused the halt was being recinched, a dozen other mules would start exploring the neighboring thickets. Sometimes the whole train would be thrown into confusion and all the pack animals would have to be rounded up and the packs readjusted.

It was in this section that we found

An accident to one of the pack mules of the expedition on the Inca-Chaca trail.— Expedition beginning ford of a mountain stream

the first traces of the vampire bats which later cost us two mules. These blood-sucking mammals descended every night, and in the morning the backs of several of our animals would be wet with blood. The bats attacked the spots on the skin which had been chafed by the packs and although we tried several methods to keep them off, they continued the injuries, so that the mules were slowly weakened, and there came a time when two of them could travel no farther.

A characteristic steep climb through the Andes.— The Bolivian Yungas between Todos Santos and the Chaprêa rank among the natural wonders of the world. Daily the changing vistas of palms, ferns and flowers, with cascades and waterfalls, make a delightful background for the abundant bird life

The season was not good for collecting since the birds were moulting and the rains heightened the difficulties of preserving the specimens and made trapping unsatisfactory; but the change in the fauna and flora as each new level was reached proved intensely interesting. From rugged and barren cliffs at the crest of the Andean pass, each day brought more abundant foliage, until in the mountains of the Yungas at an altitude of five or six thousand feet, a profusion of tropical growth appeared.

It was very easy to get lost in the thick jungles along the river beds. Mr. Cherrie, having had experience of this, arranged a gunshot signal to be fired by any one who should lose himself while hunting. A member of the party on one occasion, wandering far from

camp, so completely lost both his way and his head that he forgot to signal, and spent the afternoon tearing through brush and brake in a direction still farther away from camp until finally he heard a far-off signal from the others, who were getting anxious at his non-arrival.

There were no wild animals of a kind to be feared by man along this route. Along the banks of the Chaparé we found evidences of tapir, paca, capybara, jaguar, tiger cat, peccary, deer, coati, agouti and others, but the high water, which varies sometimes forty feet between seasons, had driven game to the highlands making hunting possible only at the highest points along the Mamoré. Bird life was most abundant in Bolivia; a collector could spend several seasons to advantage in these little traversed routes across the South American states. When the incidental mishaps and inconveniences are forgotten, the Bolivian Yungas between Todos Santos and the Chaparé may well be compared with other natural wonders. Daily the vistas of palm, fern and floral growth, with cascades, waterfalls and freshets, make a delightful background for the abundant bird and other animal life.

At the beginning of the Chaparé the Yungas disappeared and our *arriero* now led the way down the river bed, or through the cane and bamboo brakes, pushing on through mud and water. Due to good chance our camps remained above water except in two instances. One night in particular the rains filled the Espirito Santo and San Antonio rivers and left us in three feet of water at daybreak.

Cutting out a new trail five hundred feet up the face of a cliff where a slide had obliterated the path. This point in the trail is known as "Sal-si-puede" ("Get out if you can")

At this place we had to wait nine days before we could ford the swollen river, and when at last we essayed the crossing, urged on by the sight of a more secure camping place on the farther bank, we speedily regretted the attempt. The mules became panic stricken in mid-stream, turned, and were whirled into the rapids at the junction of the two rivers where four of them were swept away. Four crossed in safety; the others were left with the *arriero* who took them back to Cochabamba, while our party continued on foot, until several days' journey below where we found smooth water and a dugout canoe.

Halfway down the Mamoré River lies Trinidad. Again the seasonal rain played havoc with our shooting. In summer Trinidad is high above the river bed, but in March we entered the main street by canoe, and when we stepped out on land we were almost in the plaza of the town. In the pampas around the city many interesting studies could be made. The macaws and toucans gave way here to egrets, ibis and spoonbills, while the oven birds with their homes of red clay, and the huge hills of the termites, were on every side. Trinidad would be an excellent cattle center but for the poor grazing facilities during the winter. Two hundred miles below, Señor Suares, a Portuguese known as "the Rubber King," has fifty-thousand head, from which the supply of dried beef is drawn for his rubber camps.

Proceeding by the river steamer to Guajamarim, we here changed to the

Weaving a poncho from yarn made from the wool of native sheep and spun by hand. Weaving is the great industry for the women. Wherever a woman is seen, in the fields or market places, or even walking to and from market, she is constantly spinning. The ponchos and skirts of the Indian have always been handmade and home-made in the past. Of recent years German agents have sent patterns of Indian garments to Germany where they have been copied almost exactly in color and less exactly in pattern: therefore today the Indian may exchange his agricultural products at the shops in the towns for German-made clothing of inferior quality]

Growing the potato in Peru, its original home. The photograph shows a potato field at 13,000 feet elevation. Potatoes grown in Peru are always of small size. They are prepared for keeping over the season by a process of freezing and drying. The Indians of the high Andes are an agricultural people. They cannot raise corn as in lower altitudes but replace it with barley. Men take a share of the work in the fields with the women

Stirring a pot of *chicha*.— What may truly be called a national drink is made from corn, which is boiled, dried in the sun, pulverized between stones and finally brought again to a boil with sugar. As an early step in the process portions of the boiled corn are masticated and returned to the pot, the addition of saliva hastening the fermentation.

Drinking *chicha* and chewing coca leaves are the two indulgences of the South American Indian

Madiera Mamoré Railway, passing the great falls of the Madiera. This road, constructed at a cost of many millions of dollars and hundreds of lives, fails to fill its mission. Built as a link between Bolivia and the commerce of Europe and the United States, the freight charges are so high that rubber from the upper Mamoré is still packed over the Andes to the west coast with weeks of toil, and imports likewise are brought in by train and mule. We paid fifteen cents a pound for baggage over these two hundred and fifty miles of road. After this we went on to Manaos by river steamer, and from Manaos the whole length of the Amazon was traversed by steamer, to Pará at its mouth on the Atlantic.

The best shooting of our trip, from the sporting point of view[1] was at Pampa del Arrieros in Peru, thirteen thousand feet elevation. Making this small town a base, we worked up to the snow line, which begins between eighteen and nineteen thousand feet above sea. Between the heights of thirteen and seventeen thousand feet we obtained several specimens of vicuña and guanaco. Groups of these will be mounted at the Field Museum, Chicago. Hunting in the Andes presents few difficulties except those due to altitude and the attendant atmospheric conditions. Above fifteen thousand feet, climbing in the rarified air is slow and laborious, and the few nights we spent in the open at these altitudes were cold and sleepless.

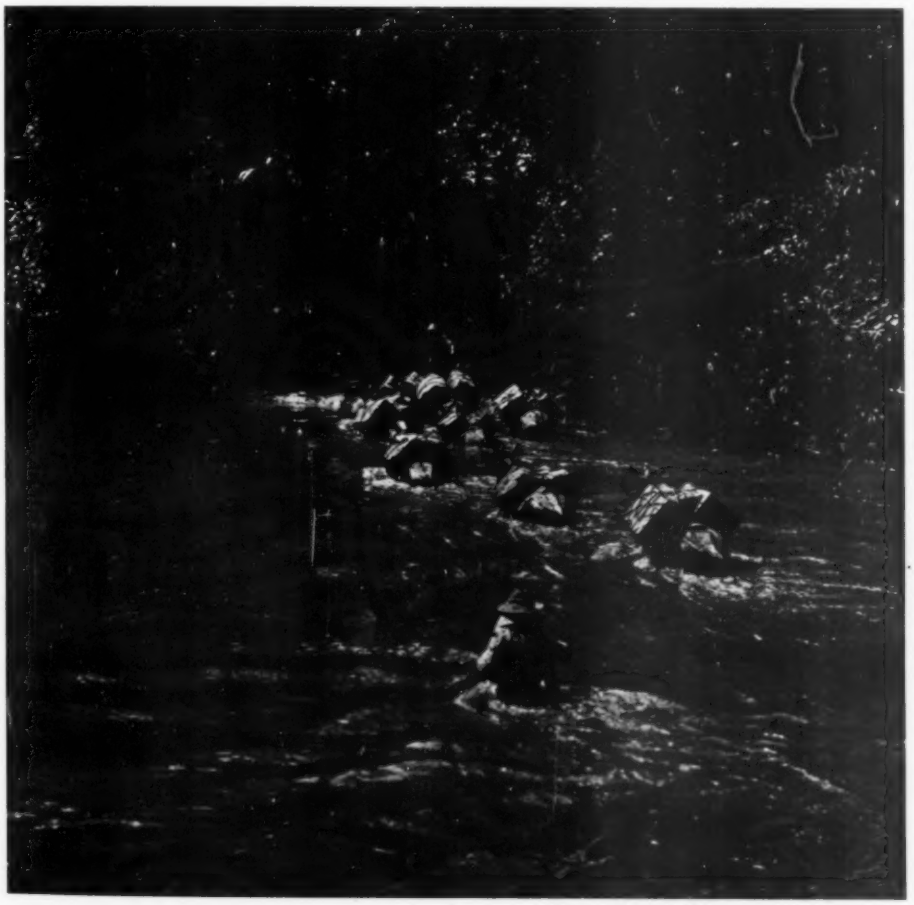
In spite of the weather drawbacks, which made collecting often impossible and preparing specimens always difficult, the expedition was able to obtain fifteen hundred bird skins and about five hundred small mammals for the American Museum.

[1] From the scientific point of view, the best collecting was found at Parotain, Todos Santos and Trinidad, points in Bolivia, where many rare forms of birds and small mammals were secured.

Before reaching Mollendo we visited the ruins of the ancient Peruvian city Chan Chan, near Trujillo. This formerly covered a square mile and little is known of its origin, except that it was built before the coming of the Incas. Only mud walls are left, the city having been plundered and destroyed by Francisco Pizarro, the Spanish discoverer and conqueror of Peru, who found much treasure there. On the walls rough bas-relief is still visible, the clay having stood climatic changes for five or six hundred years

REPRODUCTIONS IN DUOTONE OF PHOTOGRAPHS BY MEMBERS OF THE COLLINS-DAY SOUTH AMERICAN EXPEDITION, GIVING GLIMPSES OF TRAVEL AND LIFE IN THE HIGH ANDES

This expedition, sent out under the auspices of the American Museum of Natural History, was financed by Messrs. Alfred M. Collins and Lee Garnett Day, who generously donated to the Museum on their return zoölogical collections brought together in crossing the South American continent from Mollendo on the west coast to Pará on the east. The expedition brought back also fifteen hundred photographs and ten thousand feet of motion-picture film



FORDING A RIVER IN THE ANDES

The expedition, when 3000 feet and more above sea level in the Andes, was often obliged to cross streams fifteen or twenty times a day—wide or narrow, shallow or deep with swift current, all flowing on their course down from the higher watersheds to make up the river Chaparé. A trip that in the dry season might have been made in five days required twenty-four in the rainy season, but had the advantage of allowing large collections of birds and mammals to be brought together in a little-known country

DANGERS OF THE SOUTH AMERICAN TRAIL

The trail in the locality of Sal-si-puede often led along the cliff five hundred to one thousand feet above the Espirito Santo. A single false step or a slide of the sand from under a mule's feet could result only in disaster. The expedition crossed safely except for the loss of one mule

A single false step or a slide of the sand from under a mule's feet could result only in disaster. The expedition crossed safely except for the loss of one mule

MARSHY BORDERS OF LAKE TITICACA

The surface of Lake Titicaca, five thousand square miles in extent, lies among the peaks of the Andes, twelve thousand feet above sea level

NATIVE BOATS ON LAKE TITICACA

Balsas anchored in the shallow marshes near the shore. The *balsa* is made of bundles of reeds lashed together. It is the same sort of craft that was in use by the Indians at the time of the Spanish conquest, more than four centuries ago, and is today the only boat used for native commerce along Lake Titicaca

READY FOR CARNIVAL TIME AT COCHABAMBA

Indian boys deck themselves and their donkeys with trailing mosses

THE LLAMA OF THE ANDES

The llama had been domesticated by the Indians before the Spanish conquest and it still remains their beast of burden. The Indian is very gentle with his llama, never striking it a vicious blow. The flocks are carefully tended by the Indian man or woman, the former playing his flute, the latter industriously spinning. All of the clothing of the country is made from the wool of the llama, alpaca, vicuña, and native sheep

AN ANCIENT SPANISH BRIDGE ON THE TRAIL

Most of the Andean trails, which are wide enough for mules in single file only, were made during the time of Spanish occupation. Frequently, where the trail leads across the narrow cañon of a mountain torrent, the space is spanned by the masonry of an ancient bridge, although many such bridges have broken down through neglect and the four centuries of use

A MOUNTAIN CACTUS LENDS ITS GREEN TO THE HIGH DESERTS OF PERU

A WEARY RETURN TO CAMP

The expedition found guanaco (see back load of the first mule) at fifteen thousand feet elevation near Pampa del Arrieros (Peru). The guanaco is supposed to be the wild form from which both llama and alpaca have been developed

INDIAN MOTHER AND CHILD

Of a South American tribe at Todos Santos on the head-waters of the Chaparé. Because of the love these people have for birds and many kinds of animals, every Indian home contains numerous pets

ALONG OLD SPANISH TRAILS IN THE ANDES

View in the Yungas Valley on the Todos Santos trail, which is the route for most of the commerce between the low, hot, grazing lands of Bolivia and the high, well-populated table-lands around La Paz, Cochabamba, and Oruro. The trail is always narrow and winds through heavy woods, along sides of cliffs, and across mountain streams

A HOME BESIDE THE MAMORÉ RIVER

Native children with wooden mortar used for pounding yucca or coffee. In descending the Mamoré, the expedition had many opportunities to make the acquaintance of the natives because of the necessarily frequent stops of the boat for firewood

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The Grim Wolf of the Tar Pits

THE GREAT EXTINCT WOLF FROM THE ASPHALT DEPOSITS AT RANCHO LA BREA NEAR LOS ANGELES

Skeleton of Canis dirus recently mounted in the American Museum

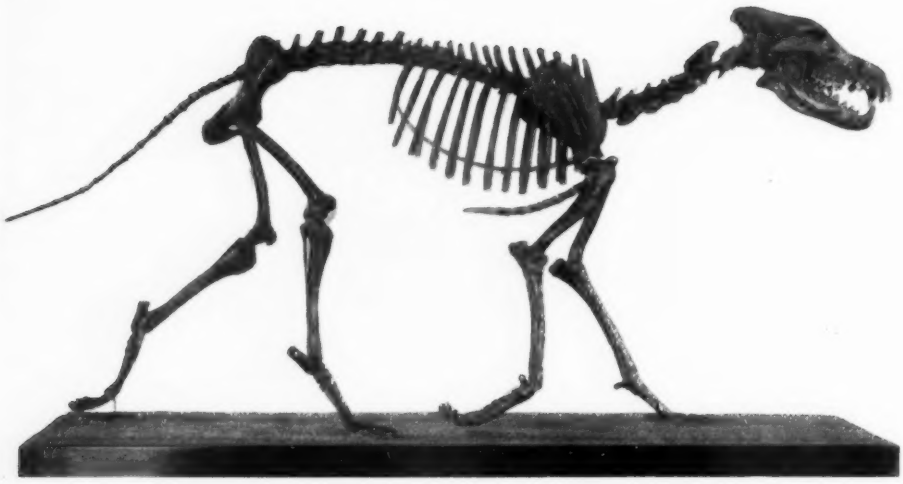
By W. D MATTHEW

NO doubt the purist will take exception to my title, if he happens to notice it. The Latin adjective which I have freely translated by "grim" means rather dire, dreadful, terrible, than grim (*L. torvus* or *trux*). And tar of course is not really the same thing as asphalt. But the objection is after all rather superficial; for the expression "grim wolf" is a familiar one, and whether used in fairy tales or in classic poetry it seems to carry a reference rather to the destructive and terrible qualities of the animal than to any harshness or savagery of aspect. For the wolf is after all a handsome beast; fully equal in good looks to his domesticated brethren, and distinguished from them only by the untamed wildness of his ways and a disposition to include human beings and other fairy tale heroes as proper, not to say principal, items of his diet. On these grounds I hold that "grim wolf" is a perfectly proper and accurate translation of *Canis dirus*. It is at least as good as any other term that could be substituted, and more familiar and euphonic.

As for tar pits of course, it is incorrect — asphalt is n't tar. But it looks and acts like tar, and the phrase gives just the concept one wishes to convey of the black, semi-liquid tenacious substance that filled these pits or chimneys during the time when they were active, and served as a trap for the unwary animals that ventured within its clutch. Whereas asphalt, to the average reader, is connected with hard firm roads, a bit slippery for animals in wet weather but not at all like the treacherous soft substance of the La Brea pits. Tar-pits is the term in common use in Los Angeles as far as I could observe, and this is probably the reason why.

But enough of linguistics. The subject of this notice is a new fossil skeleton just installed in the hall of the Age of Mammals on the fourth floor of the American Museum. This extinct wolf is a near relative of the living wolves, which range all over the northern world, but is of somewhat larger size, and distinguished from any of its modern congeners by various small peculiarities in the teeth and skull. Its remains have been found in the older Pleistocene formations of various western states, but nowhere so perfectly preserved or so extraordinarily abundant as in the asphalt deposits at Rancho La Brea, where it is the most abundant of all the marvelous fossil fauna of that unique formation. More than a thousand complete skulls, and a proportionate number of skeleton bones have been disinterred there, chiefly by the Los Angeles museum and the University of California. Dr. Merriam tells us [1] that *Canis dirus* "was evidently the dominant type of wolf in this region at the time of deposition of the asphalt beds. This species includes the largest individuals of the *Canis* group known from America. Some of the specimens exceed in dimensions all

[1] Merriam, J. C. "The Fauna of Rancho La Brea," Part II, Canidæ, *Memoirs of the University of California*, Vol. I, Part II, p. 218.



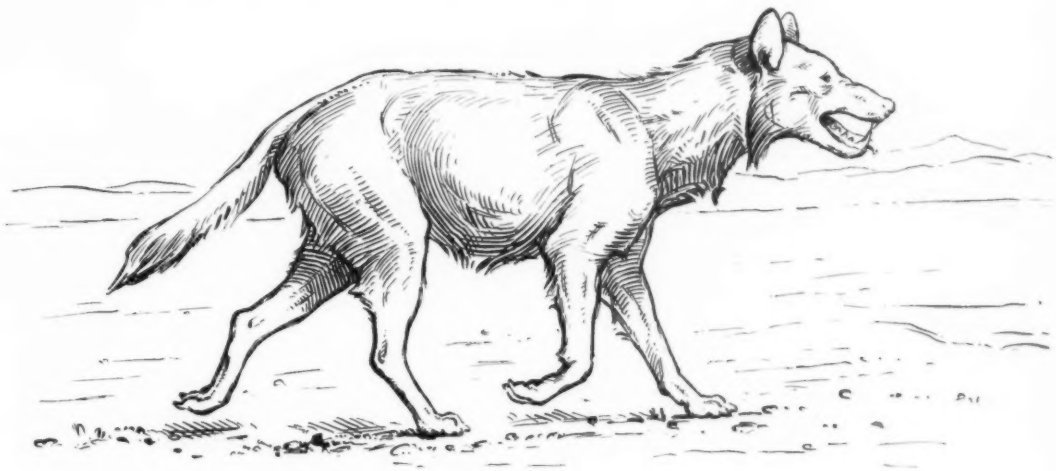
New fossil skeleton of extinct wolf recently mounted in the American Museum. More than a thousand complete skulls and a proportionate number of skeleton bones have been disinterred in the asphalt beds at Rancho La Brea

the largest known recent wolves. Other individuals are considerably smaller than some of the large northern wolves of the present day. The skull is especially large, and the head seems to have been relatively large compared with the limbs. The teeth are very massive, but those regions of the cheek-tooth dentition constructed especially for crushing are relatively small. The comparatively light limbs and very massive head show that the animal was not as well developed for running as are the timber wolves and coyotes. The massiveness of the dentition, without corresponding development of the crushing surface, indicates use of the teeth in smashing large bones. The form of the skull indicates that the head was normally held low and was often used in hard pulling and hauling of heavy bodies. The great number of individuals of *Canis dirus* found at Rancho La Brea, suggests that the wolves of this species sometimes associated themselves in packs and that groups of considerable size may have assembled to kill isolated ungulates and edentates. Particularly the young of the large animals, the aged and injured, when they could be separated from their associates, would be the natural prey of the great wolf, but adults in normal strength may also have succumbed to the combined attack of several of these powerful animals." Dr. Merriam gives the length of one of the largest skulls as 282 millimetres ($11\frac{1}{10}$ inches).

The skeleton shown in the photograph is that of an unusually large animal, and was presented in exchange by the University of California. It has been mounted by Mr. Adam Hermann, the pose selected being a characteristic phase of the trot. A trotting mastiff in the Muybridge photographs of *Animals in Motion* served as guide. This is the step that would commonly be used in a long chase. It suggests the grim, unrelenting, tireless pursuit of its prey, seen far away across the bare rocky hills of Southern California, and affords an interesting contrast to the pose of the skeleton in the "Asphalt Group", which stands excited, hesitant, feet wide apart,

undecided whether to leap aside from the near presence of the dangerous sabre-tooth tiger, or to dash in on it if its entanglement has rendered it helpless.

In the trotting step two feet are lifted from the ground together, right fore and left hind alternating with the opposite couple. The body is pitched forward from the spring of the right fore and left hind limbs, the alternate couple have reached forward to the next step, the neck and head are stretched rather stiffly forward, while a faint curvature from side to side in the backbone is caused by the slight twist of the pelvis and the alternating pull of the shoulder and hip muscles on the back. All these details if correctly represented serve to give a lifelike appearance to the mounted skeleton, so that it is not difficult to sketch in mentally the outlines of the great wolf pursuing his distant prey over hill and valley with unwearied pertinacity. For the grim wolf of the tar pits was a veteran of the chase, and must have had a long career of successful hunting before he rashly adventured upon the treacherous surface of the asphalt spring and came to an inglorious and miserable end in its sticky depths.



It is not difficult to sketch in mentally the outlines of the great wolf pursuing his distant prey over hill and valley with unwearied pertinacity. Restoration by Mr. Erwin Christman

THE GREATEST CHIEF OF THE PAWNEE INDIANS

Petahlayshahrho, chief of the Skídi band of the Pawnee from 1852 to 1874. Owing to the heroic efforts of his father, of the same name, the custom of human sacrifice had been discontinued in this tribe as a public ceremony. It was however still occasionally repeated in secret, and was only finally abolished as a result of the persistent campaign of this man who, as the greatest chief of his tribe, was later prominent in negotiating the treaty of 1858

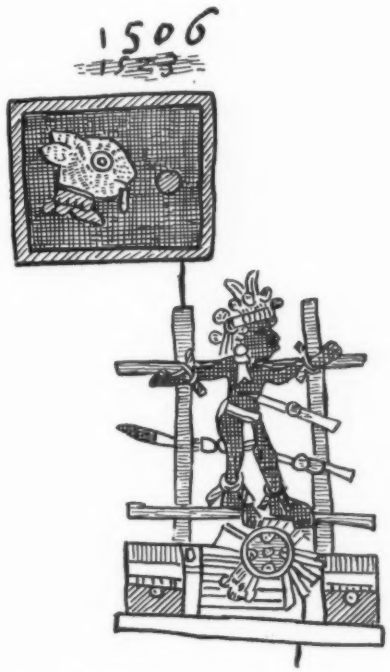
The Pawnee Human Sacrifice to the Morningstar

By CLARK WISSLER and HERBERT J. SPINDEN

SOMETIMES it happens that the most insignificant looking object has the most interesting history. In the Museum's Pawnee Indian collection is a simple pair of thongs, but slightly decorated, which of themselves would escape notice, yet which stand, so far, as our only objective representation of the Pawnee human sacrifice ceremonies. The historic home of the Pawnee was Nebraska, where they resided until moved to Oklahoma in 1876. They were to some extent an agricultural people but were also great buffalo hunters. They had a highly developed ceremonial and religious system in which certain stars in the heavens were the leading gods. One very bright star, probably Mars, was the Pawnee god of war, although often spoken of as the Morningstar, and there was in the keeping of certain priests a ritual for the sacrifice of a captive to this star. While the sacrifice was made only when the star was in a certain position at dawn, it was not an annual occurrence but was given only when the Morningstar himself called for it. This he did by appearing to an individual in a dream or vision. Then war parties were sent out until a captive maiden was secured. She was kept under guard but otherwise treated like a goddess until the time of the sacrifice.

The accessories for the sacrifice ceremony were provided by various individuals. The thongs mentioned above were intended for tying the hair of the captive.

It seems that the Pawnee had for many years performed this gruesome ceremony somewhat unwillingly, impelled by a sense of religious duty. It is said that the officiating priests always found it a sore trial. One time about 1818, as arrangements for a sacrifice were under way, a bold young man decided to rescue the captive. At the psychological moment he interrupted the proceedings and announced it as his intention to free the captive at any cost. He then cut the poor girl loose from the scaffold, carried her swiftly through the awestruck crowd, mounted his horse and dashed away. When beyond pursuit he gave her a horse and sent her on her way.



The scaffold sacrifice among the Aztecs of Mexico City, as shown in a drawing from the *Codex Telleriano-Remensis* recording its first appearance. The symbol of the year One Rabbit appears above, below it being recorded the important events of that year, beginning with the sacrifice. The date was written in later by a Spanish priest who interpreted the native manuscript with valuable marginal notes

Thongs used by the Pawnee Indians to tie the hair of the maiden to be sacrificed. They are made of buffalo hide, painted red as a sign of blood, and small deer-hoof rattles are attached to the ends. Underneath the beadwork decoration a small quantity of buffalo hair is tied for obscure ceremonial reasons

Then returning to the village he announced his opposition to the continuance of the ceremony. As he was already a distinguished warrior and the son of the chief's sister, which according to the Pawnee system, gave him the hereditary right to succeed his uncle, many strong men rose in his favor and pledged their future support. The name of this man was Petahlay-shahrho. In 1821 he visited Washington, D. C., and a medal was presented to him by the ladies of that city in recognition of his humane deed. Nevertheless, the ritual of the sacrifice was still regularly performed as a formal matter and many conservative individuals looked forward to a revival of the sacrifice itself. In anticipation of this, vows to furnish the accessories were still made.

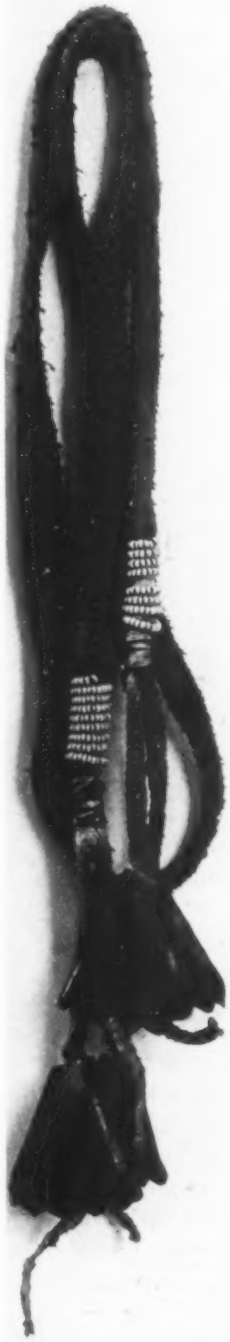
Thus it was that a man by the name of White-horse, while the tribe was still in Nebraska, made a vow that if he were fortunate during the year he would give the thongs for the next Morningstar sacrifice. Things came his way and he did as he had promised, but the thongs did not serve the purpose intended because the sacrifice had been discontinued. He was bound to preserve them however, and at his death passed them on to his family and thence to the keeping of the American Museum.

To the serious-minded reader this human sacrifice ceremony of the Pawnee presents some interesting problems. So far as we know there was nothing like it among the other Plains tribes, nor anywhere else in the United States and Canada, except possibly in Arizona and New Mexico; but in ancient Mexico we find some curious parallels. The Pawnee captive was tied upon a rectangular frame, which according to descriptions consisted of two upright poles and five cross pieces. Four of these cross pieces were in the nature of steps, to the top one of which the feet were bound, and the arms were made fast to the fifth cross piece. Scaffolds of this kind are pictured in Mexican codices. The idea in the Pawnee sacrifice was to offer the victim's blood and to cut out the heart, which was also the Mexican idea. Again, the Pawnee ritual required that the captive should be induced to do everything of her own free will, even to mounting the scaffold; this also has its Mexican counterpart. The Pawnee captive was shot full of arrows; the Mexican codex sketches show many arrows sticking into the sacrifices. Finally, there was an astronomical idea involved, and there is reason to believe that this also was characteristic of the Mexican

rites. All this suggests an historical connection between the Pawnee and Aztec cultures, and since the Pawnee is a small group compared with the latter, the probabilities favor the Mexican origin of the ceremony.

Let us now turn our attention to the question on its Mexican side. The scaffold sacrifice may have been invented by Moctezuma II in 1506, or more likely, it may have been taken over into Aztec ritual at that time from some tribe in southern Mexico. The early Spanish interpreter of the *Codex Telleriano-Remensis*, writes under the year One Rabbit (1506): "In this year Moctezuma shot with arrows a man in this fashion [referring to the illustration], say the old men, because for two hundred years there had always been hunger upon the year One Rabbit."[1] The unexcelled historian of the Indians, Fray Bernardino de Sahagun, refers to the same year (in which Zozullan had been captured) in these words: "The Mexicans killed many of those from Zozullan which they took in war, and placing them as a windmill's wings between two poles they shot them, and each year they made this fiesta." In addition to the representation of this sacrifice in the historical portion of the *Codex Telleriano-Remensis* (and its copy, the *Codex Rios*), there are other representations in the *Codex Nuttall*, the *Manuscrit du Cacique* and the *Codex Porfirio Diaz*. All of these are native books made before or just after the coming of the Spaniards.

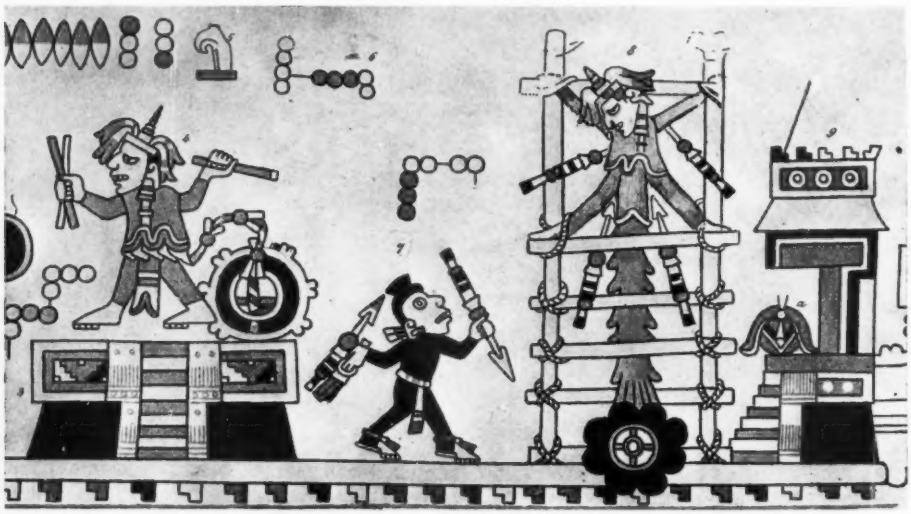
The scaffold sacrifice was evidently associated by the Aztecs with the feast of the month Tlacaxipehualiztli. This feast was sacred to Xipe Totec, the Lord of the Flayed, a war god whose appalling cult had spread far and wide over Mexico and Central America. The feature of Xipe worship which has attracted most attention was the wearing by warrior priests of the skins of flayed victims and the holding of a mock battle in this gruesome attire. It may be added that the earliest reference to scalping is in connection with the cult of Xipe. Another ceremony performed at this feast was a sort of gladiatorial contest in which a captive, bound by a rope to the center of a great stone disk and armed with a short wooden club, was compelled to fight four warriors fully armed, two wearing jaguar-hide costumes and two dressed to represent eagles. In the drawing from the *Manuscrit du Cacique* the ceremonial of the stone disk is indicated at the left. The rope passes from the victim's waist to the center of the stone. The handicapped



[1] According to the Aztec system the year One Rabbit recurs every fifty-two years.

gladiator wears the characteristic blood-red dress of the god Xipe Totec. Before a temple at the right is the scaffold, the cross bars of which are tied with ropes. To this scaffold a victim, also wearing the costume of Xipe Totec, is bound. A priest, whose body is painted black, has pierced the sacrifice with several arrows and the blood is streaming down.

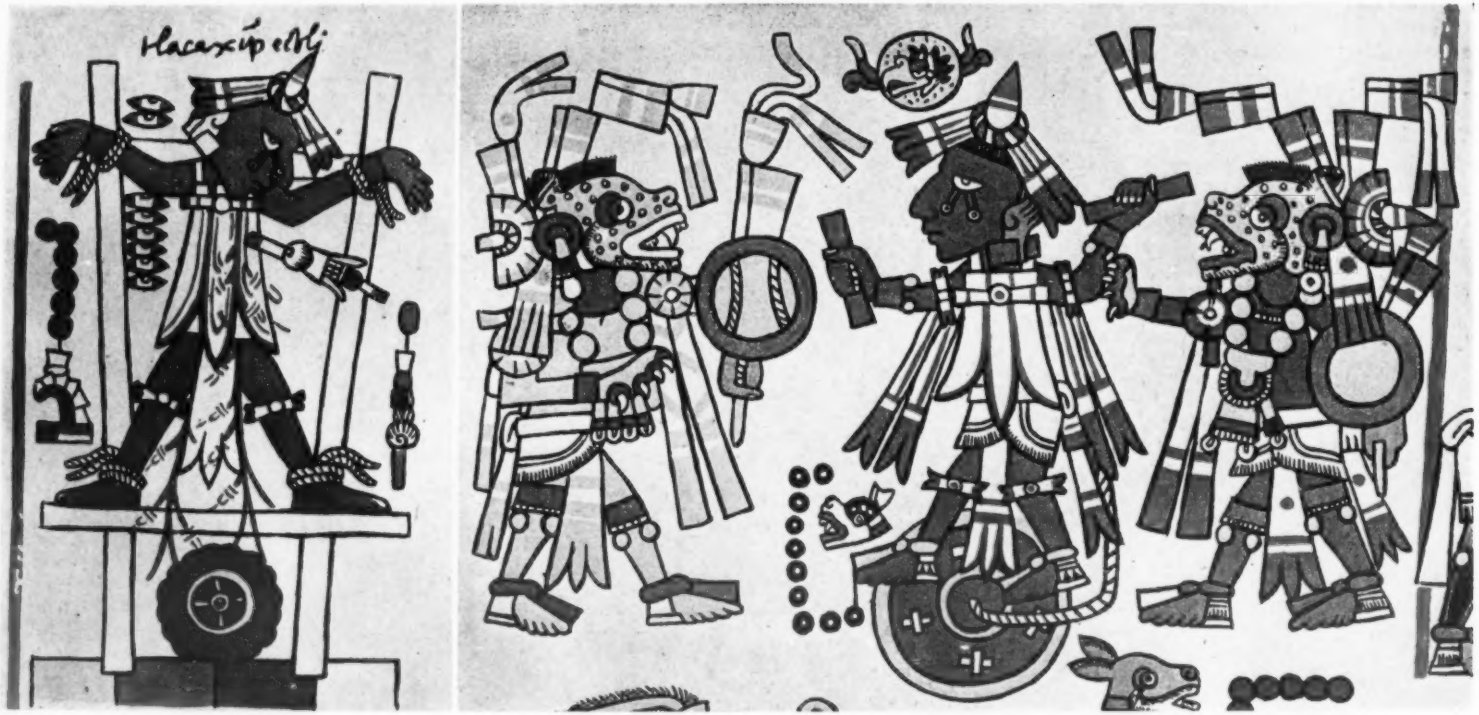
In the *Codex Nuttall* the contest on the stone disk is more fully represented and that on the scaffold is somewhat



The Mexican feast to Xipe Totec, the Lord of the Flayed, representation from the *Manuscril du Cacique*. A temple is depicted at the right, before which a captive taken in war is being sacrificed on a scaffold. A priest garbed in black is throwing arrows at the victim with an *atlatl*, or throwing stick. At the left is shown the contest of the stone disk, in which another captive fights four armed warriors. Both victims wear the blood-red costume and head-dress of Xipe Totec

abbreviated. There is a remarkable uniformity however, in essential details. The day Six House is recorded in both pictures and there are also figured eight sacrificial knives. Under the sacrifice on the scaffold is an object which may represent the sacred bowl used to catch the blood.

Two human sacrifices on scaffolds are drawn in a somewhat more realistic fashion in the *Codex Porfirio Diaz*. In each picture we see a temple (drawn out of scale as always) and before it a scaffold with four cross beams at the bottom and one at the top. The victim is stretched across the open space and his body is pierced by arrows. In one picture we see a priest in the act of shooting. Behind the temple is a pole with some sort of framework at the top and with a rope hanging to the ground. Various individuals are also shown, each with his name hieroglyph above his head. There is nothing to indicate that the scaffold sacrifice is here connected with the feast of Tlacaxipehualiztli. Above the upper cross bar in one case there is a heart, which may indicate that this vital organ was offered to the divinity in whose honor the ceremony was celebrated; in the other case there is a disk-shaped object which doubtless represents the sun or some other heavenly body. There is good reason to believe that the scaffold sacrifice originated in southern Mexico and that it was connected primarily with the sun or some important planet and secondarily with war. Most of the



ANCIENT RECORD OF HUMAN SACRIFICE

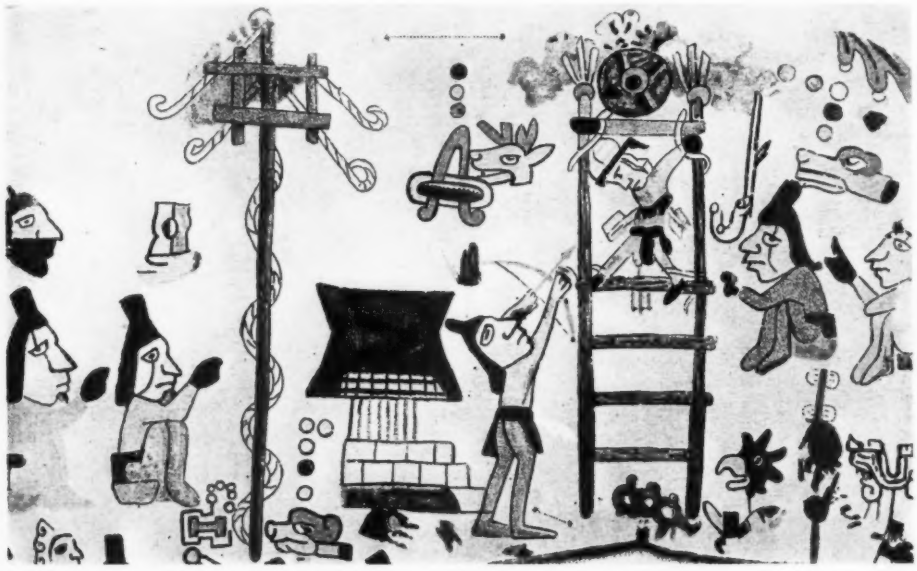
Feast of Xipe Totec as depicted in the *Codex Nuttall*. This is probably the most beautifully preserved of all the native manuscripts. Written on deer-skin and folded like a Japanese screen, it records conquests, ceremonies, etc., and is generally accredited to some tribe of the State of Oaxaca, Southern Mexico. The gladiatorial contest of the stone disk is here clearly represented. The captive gladiator, fastened by a rope round the waist to the center of the disk and armed only with wooden clubs, fights four fully armed warriors, two dressed as eagles and two (the ones shown above) as jaguars. Tears run from his eyes

At the left is shown the scaffold sacrifice

native records of this sacrifice refer to southern Mexico and are largely concerned with astronomy.

From these pictures alone we should be unable to obtain more than an objective similarity to the human sacrifice among the Pawnee. But Sahagun and other early writers give us intimate studies of acts and thoughts of the Mexicans that could hardly be expressed in drawings. Many ceremonies are described; some occurring at fixed times in the year, others at a time regulated by the *Tonalamatl*, or book of days, or by the rising of some star or planet. The psychological attitude toward human sacrifice comes out clearly in many of these accounts.

Ceremonialism was intensely developed in Mexico and the dramatic quality of many Aztec rites of human sacrifice has probably never been equalled. We are apt to think only of the gruesome features of human sacrifice and to overlook the spiritual ones. The victim was often regarded as a personification of a god and as such he was fêted, clothed in fine garments, and given every honor. Efforts were made to cause him to go willingly to his death, uplifted by a truly religious ecstasy. It was considered unlucky that he should grieve or falter. To give an example: On the last day of the month Toxcatl there was sacrificed a young man chosen from captured chieftains for his beauty and accomplishments. For an entire year this intended victim, gayly attired and accompanied by a retinue of pages, had been granted the freedom of the city. When the month of Toxcatl entered he was given brides whose names were those of goddesses, and in his honor was held a succession of brilliant festivals. On the last day there was a parade of canoes across Lake Texcoco, and when a certain piece of desert land was reached the brides and courtiers bade farewell to the



One of two drawings in the *Codex Porfirio Diaz* representing a scaffold sacrifice. This manuscript is preserved in the National Museum in Mexico City and is accredited to the Ciucatecan tribe of the State of Guerrero. Before a crude drawing of a temple, a priest shoots arrows at the victim before the eyes of onlookers who sit and watch

victim. His pages accompanied him by a little-used trail to the base of an apparently ruined temple. Here he was stripped of his splendid garments and of the jewels that were symbols of divinity. With only a necklace of flutes he mounted the steps of the pyramid. At each step he broke one of the flutes and finally arrived at the summit, where the priests, knife in hand, awaited the naked man whose heart was to be offered to the very god he had impersonated. This ceremony is given only as an example, but it illustrates two characteristics found in several other Mexican sacrifices — namely: the paying of homage and honor to the person chosen for death; and secondly, the necessity of keeping the victim in good spirits and of inducing him to act voluntarily through the ritual. Where women were concerned deception was used, but with men an attempt to inspire a religious exaltation, triumphing completely over the weaknesses of the flesh, appears to have been practised.

A leader in the Pawnee ceremony of human sacrifice

If a real connection between the concept of human sacrifice among the Pawnee and among the Mexicans should be proved by these facts, we must remember that the extension to the north must have taken place before 1519 — when the arrival of the Spaniards cut off abruptly the ancient religious rites of the Mexicans — and that it probably took place only shortly before this date since the Aztecs themselves seem to have acquired the rite no earlier than 1506.

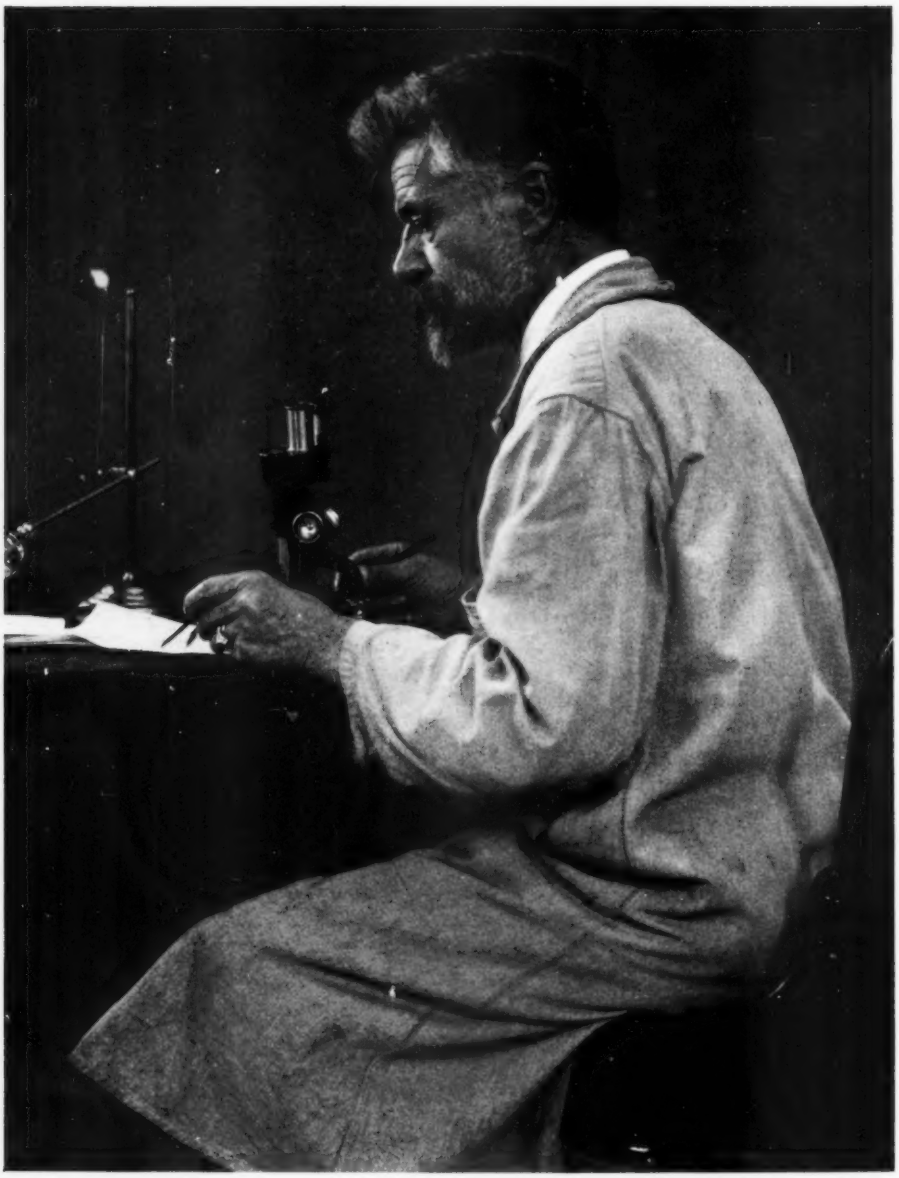


Photo by Mr. Julius Kirschner

IGNAZ MATAUSCH

His recent death is an almost irreparable loss to the Museum's technical constructive work. Mr. Matausch's work of many years has been done under the supervision of the department of invertebrate zoölogy, which will tell in the next issue of the JOURNAL the story of his connection with the department and of his many masterpieces of work in wax modeling for the Darwin hall. [This photograph was taken for the JOURNAL but a fortnight before his death]

Ignaz Matausch

HIS CONTRIBUTIONS TO THE HALL OF PUBLIC HEALTH

By C.-E. A. WINSLOW

THE most striking feature of the hall of public health is the case of monster models of insect carriers of disease. These models, which include the four stages in the life history of the fly; the flea (carrier of bubonic plague); and the egg and adult of the body louse (carrier of typhus fever), represent the last contributions of Ignaz Matausch to the American Museum.

No one who has not watched the process can guess the almost infinite detail involved in the preparation of these wonderful models. Days of patient work are first needed in studying the habits of the insect and in breeding it so that abundant living material in all stages may be obtained. Then every part, every tiny hair, every minute sculpturing must be worked out and to scale, each observation being checked up, by the examination of a series of individuals to eliminate abnormal variations, and by comparison with living specimens to avoid the distortion due to death changes. Each part of the model is then modeled and cast and finished and fitted together, the proportions being studied and compared with life at every stage. I suppose Mr. Matausch has said to me a hundred times, "You see, this must be right in the *extreme*."

When the model has been put together and the hairs and scales have one by one been prepared and fitted exactly in place, when the coloring has been completed with the same exhaustive care, it is no wonder that such a model as the fly took a year of solid work on the part of its tireless creator.

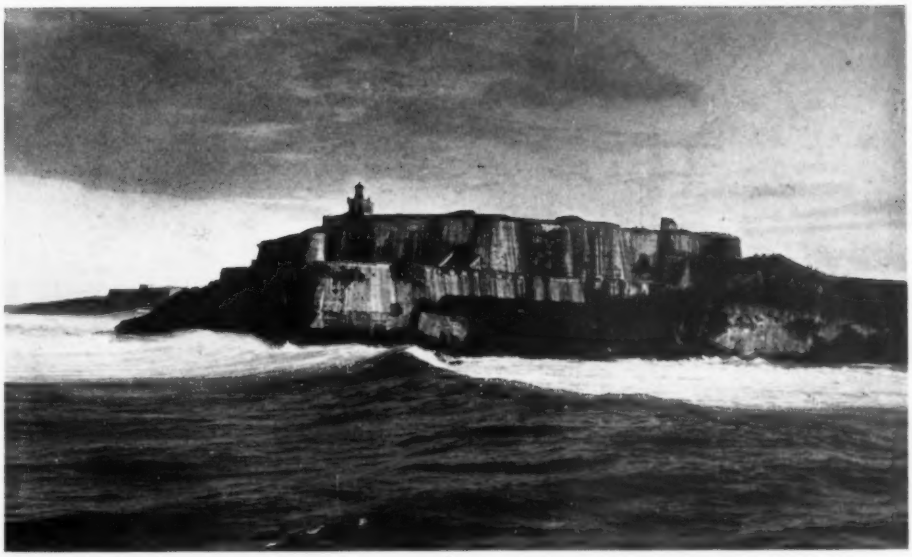
The model of the flea was prepared by Mr. Matausch largely outside of regular Museum hours, which were taken up with other preparation work. The model of the louse was made entirely in this way and was presented to the Museum as the gift of Mr. Matausch. It is a satisfaction to me to remember that some of the last weeks of his life were made happy by his election to life membership in the Museum as a recognition of this generous gift.

Mr. Matausch worked before hours and after hours, on Sundays and holidays, for the Museum and its officers, for his loyalty was fervent and intense. Above all however he worked for the love of his work, which absorbed and consumed him with a power such as I have never seen equalled. He said to me once, "I love this work so. The only hard time in the day is the morning hour in the subway — for then I am so anxious to get to work." Watching him, one had visions of monks bending over their task of pious illumination, of Renaissance artists decorating some chapel ceiling. Ignaz Matausch worked in a different medium but he was in spirit a brother to every one who has ever labored with utter self-abandon for an ideal of perfect work.

The model of the Aedes mosquito, carrier of yellow fever, upon which Mr. Matausch was engaged for the six months before his death with consuming enthusiasm and which he rightly believed would have been most beautiful of all his contributions, was left unfinished. The models already completed however, will long stand as a monument to a great Museum artist; and the memory of his ardent and tireless personality and of his complete devotion to the attainment of the perfect result will remain a living influence with all of us who knew him.

IN GROWING "SHADOW TOBACCO", A MOST UNUSUAL LANDSCAPE IS PRODUCED

Great fields of tobacco spread through the valleys and over the hills of the interior. Cheesecloth is spread over the plantations, to guard them from insects and the too intense rays of the sun



On entering the harbor of San Juan, the ship passes close to El Morro ("The Castle"), an old fortress at the western end of the city

Porto Rico

By HENRY E. CRAMPTON

THE island of Porto Rico undoubtedly surpasses all other regions of equal size — certainly of the New World — in the variety and number of its features that arouse vivid interest. The extent of the island is not great, for its irregular oblong mass is only one hundred miles in length and about thirty-five miles in breadth, or approximately three times as large as Long Island; yet its inhabitants number more than 1,200,000, thus making it more thickly populated than any other equivalent area in the Western Hemisphere, excepting certain portions of New England. Its place in history is a large one, for since its discovery by Columbus in 1493, it has served as the battle ground of Spanish, Dutch, and English, and as a haven for the buccaneers who operated throughout the Spanish Main. Even in purely scientific respects it commands the interest of many a department of investigation, because its different portions display unusually varied geological and topographical characters. They also support well diversified forms of plant and animal life, whose study is especially important on account of the island's value as a link in the Antillean chains that connect North and South America with each other and with Mexico. Hence the problems of evolution, distribution and migration, of human beings as well as of organic forms in general, are particularly well defined and engaging in the case of Porto Rico.[1]

[1] For these and other reasons, the New York Academy of Sciences has undertaken a prolonged and comprehensive survey of the island, for which it has gained the support of the Insular Government and active participation on the part of the New York Botanical Gardens, the American Museum of Natural History, and other institutions. More than a score of investigators have already taken the field for work in anthropology, botany, geology, palæontology, and zoölogy. As one of these, I have twice visited Porto Rico, and have become somewhat familiar with the delightful scenes with which the present brief article is concerned. — THE AUTHOR.

For the most part, the shores are long even stretches of sandy beach, but toward the northwest the high ground ends in a series of abrupt headlands

The tide pools and boulders constitute the homes and holding-ground of varied forms of animals and plants; they are surpassed only by the coral reefs in the richness of their flora and fauna

Porto Rico is only one hundred miles long and about thirty-five miles wide, yet its inhabitants number more than 1,200,000. Some 50,000 are crowded into the small area of San Juan, and everywhere over the island — on the open plain, in a valley near the coast, or in remote and unlikely hollows of the hills are small towns of some 15,000 each

On the southern side of the central range the land drops more rapidly to the plains of the island's periphery. Here irrigation is necessary in order that sugar cane may be grown, for the moisture of the trade winds condenses on the northern slopes. The land becomes a desert bearing several species of cactus

A SMALL PART ONLY IS LEFT OF PORTO RICO'S PRIMEVAL FOREST

The primeval forest is today restricted to small areas on the heights; elsewhere the trees have been cut down, mainly for fuel, leaving only bushes and grass

The primeval forest is today restricted to small areas on the heights; elsewhere the trees have been cut down, mainly for fuel, leaving only bushes and grass

VIEW IN THE INTERIOR OF PORTO RICO

From this massive mountain range, buttressed spurs drop somewhat suddenly to the island's coastal plain. In the mountains of the interior, the ground is not suitable for agriculture. Everywhere the royal palms stand about the fields and along the perfect roads that constitute the trunk lines of communication between the large towns

The valleys are beautiful wide basins surrounded by triangular white hills of limestone. Porto Rico with its splendid roads and many natural beauties, will always be attractive to the casual visitor — as well as to the investigator of its scientific resources

As the approaching steamer nears the northern shore of Porto Rico, where the capital city of San Juan is situated, the huge bulk of the island emerges from the haze of the horizon, and displays the jagged profile of the massive mountain range that forms the interior highland more than three thousand feet in altitude. From this great backbone the buttressed spurs drop somewhat suddenly, and irregularly for the most part, to the coastal plain of greater or less inland extent; the deep clefts of the upland valleys disappear, and one may judge how rapidly the swift mountain rivers must change to slow, winding streams upon the flat land of the island's margin. Coming nearer, San Juan and its buildings become visible and soon a point at its eastern end detaches itself from the rest to stand out as the cape surmounted by El Morro ("The Castle"), which guards the entrance to the harbor. Not until the fort is

rounded does the city itself become fully visible, for it is built on the landward side of the sandstone ridge which bounds the bay on the north. Elsewhere, for the most part, ships must lie in open roadsteads; only at Guanica, Guayanilla, and one or two other places is there anything that approaches a protected harbor like that of San Juan.

In the limestone regions, hundreds of large and small caverns have been excavated by underground streams. This cave mouth near Corozal is reached by a forty-foot climb up the face of the cliff. Once it is gained, the downward view is a striking and characteristic panorama of hill and field and stream

At first view, the city is impressive by its extent, the close construction of its ancient and modern buildings, and by the delicate pastel shades of its tinted whitewashed walls. More than fifty thousand people are crowded in dense areas, on the narrow rock mass that extends eastward from El Morro for two and a half miles to its connection with the mainland; there are plazas and open spaces, but these seem only to accentuate the concentration of living quarters. As one travels about, the same feature becomes more prominent, for on the open plain, in a valley near the coast, or in remote and unlikely hollows of the hills, one encounters town after town of more than ten thousand or fifteen thousand inhabitants. Naturally the problems of public health are of the highest importance, and of necessity they received the immediate attention of the Americans when they came into control of Porto Rico in 1898. Old methods of water distribution by casks have been extensively replaced by a system which brings water through lines of

VIEW FROM THE MOUTH OF THE COROZAL CAVE

pipes from the upland streams; and everywhere measures have been taken to reduce the severity of epidemics or to stamp them out, sometimes at the cost of buildings whose dynamited ruins show how frequent in some areas were the abodes of domestic animals that transmitted disease. On the whole, Porto Rico of today is a healthful island, with a warm climate well tempered by the trade winds, and well cultivated almost everywhere. With its splendid roads and natural beauties, it is and will always be attractive to the casual traveler, as well as to the investigator of its scientific character and resources.

The shores for the most part are even beaches of sand, with the characteristic beach grape and lupine vegetation. Toward the northwest however, bold headlands terminate in cliffs at the water's edge, below which there are broken boulders and tide pools that support varied forms of seaweeds and of animal life, and constitute rich fields for the collector. The peripheral portions of the island and the wide outer parts of the valleys bear enormous fields of sugar cane, which is one of the great staple products. On these alluvial coastal portions citrus fruits also are grown extensively, as well as pineapples. Altogether, the impression that is early made upon the visitor is one of intense agricultural industry — an impression that deepens as one's acquaintance grows.

The way into the cave narrows until after four hundred yards or more of walking and scrambling and creeping, one emerges into daylight through a small hole on the other side of the hill. Relics of the ancient tribes Columbus found in Porto Rico have been discovered in these caves

In the interior valleys, plantations of tobacco are laid out. The plants are protected by sheets of cheesecloth which, with their sharply-defined borders, seem like incongruous fields of snow upon the deep green of the hills. Even the steep slopes of the hills bear here and there their little patches of tobacco or of other crops, centering about a native hut perched precariously near the top, and set off by the graceful royal palms. Higher up, the character of the ground or of the gradient may be such as to render the region unsuitable for tobacco, yet even here coffee and cocoa are grown under the shade of specially planted trees. Little remains of the larger forest, for wood becomes scarce when so many demand it daily for fires. Only on the higher peaks of the great central mountains are there any relics of the primeval growth that once extended so widely.

On the flanks of the main east-and-west backbone of the island, composed of igneous rocks, there are broken levels and hills of limestone, full of marine fossils and other indications of their origin at the border of the ocean. Since their formation the land has risen so as to lift them many hundreds of feet above their former level. Where the rivers have worn against them, they display stratified faces of especial interest to the geologist and palæontologist.

Passing the great divide from north to south, the mountains drop more rapidly to the foothills and to the coastal plains. In the southeast the ground is still suitable for sugar and cocoanut groves; but coming west, the effect of the heights in cutting off the moisture of the trades becomes more marked, and a semi-arid region with its characteristic cactus is encountered. Here the cane can be grown only by extensive irrigation, which the Insular Government has

Within the cave thousands of bats hide in the holes of the arched roof and there are various insects and huge Arachnida with long delicate antennæ which serve them in place of their virtually useless eyes

undertaken with great success and profit. Toward the southwest, the land becomes a typical desert, and about Lake Guanica it supports little besides the association of cactus plants.

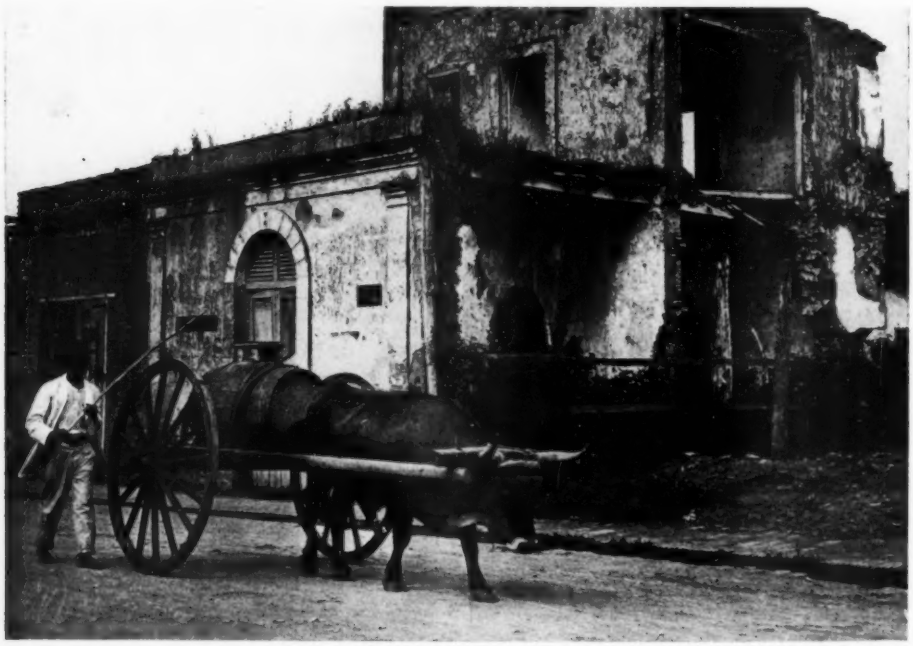
Interior of a cave above Ciales, Porto Rico. This is a cave with many mouths and a huge vaulted chamber with many stalactites and stalagmites

In the limestone regions, hundreds of large and small caverns have been excavated by underground streams. One of these, near Corozal, is well worthy of description. The valley is a beautiful wide basin, surrounded by peculiar triangular white hills of limestone, and the cave mouth, about forty feet in height, is reached by means of creepers and ledges on the very face of the cliff. Once it is gained, the downward view is a striking and characteristic panorama of hill and field and stream. On the sides of the entrance there are hundreds of spider webs, each with the dried remains of its casual collection of prey. Trending inward and upward, the way narrows until after four hundred yards or more of walking and scrambling and creeping, one emerges into daylight through a small hole on the other side of the hill. Thousands of bats hide in the holes of the arched roof, or cling to its rough surfaces. On the walls there are peculiar forms of insects and huge Arachnida, with long delicate antennæ which serve them in place of their virtually useless eyes. By way of contrast, the cave in the hills above Ciales is one with many mouths, and a huge vaulted chamber with stalactites and stalagmites above and below.

On account of the dominant Spanish influence for so many centuries, the population naturally exhibits a preponderance of the characters of that race. Only a small section however, has retained its purity, of which it is justly proud; for the most part the people are mixtures of Spanish, Negro and Indian characters. It is strange that so few are found with unmixed African features, although in certain settlements. they too have preserved many of the customs as well as the

Ancient carvings of crude design are found on the hard dense boulders along the streams

physique of their ancestors. The aboriginal type has long since disappeared, save in restricted regions where now and then a countenance displays features not unlike those of Spaniard and African. Relics of the tribes Columbus found in Porto Rico are discovered in caves, shell heaps, or about dwelling places. Very striking carvings of crude design are not infrequent on the hard dense boulders along the streams, especially in the environs of Utuado. These carvings are somewhat similar to the pictographs of St. Vincent and other Antilles and to the curious sculptures of inland British Guiana.



Ancient method of water distribution in Porto Rico, now replaced by a system which brings pure water from the rivers of the highlands

Natural History Museums and the Library

By GEORGE H. SHERWOOD

MUSEUMS and libraries are alike in that they are both educational agents of the community — the former through their explorations, researches and exhibits: the latter through their books. The purpose of each is the diffusion of knowledge, but naturally the methods of imparting this knowledge differ. The method of instruction in the museum is primarily an appeal to the eye and is based on the inherent curiosity of the individual. It is therefore elemental. The method of instruction in the library is a direct appeal to the mental traits of the individual. It presupposes previous instruction. The value of each is dependent upon the extent to which it is used. Both are faced with the same problem — namely, how to arouse and maintain the interest of the community.

The museum attracts the casual visitor and his natural curiosity is turned into a desire for further knowledge. He accordingly seeks the library as the means of satisfying this desire. The museum therefore is one of the natural feeders of the library. On the other hand, the desire of the reader to see in concrete form the objects about which he is reading, leads him to enter the exhibition halls of the museum. In such cases, the library becomes one of the natural feeders of the museum. There is a wide field then, for coöperation between the museum and the library, and especially between the natural history museum and the library. The means of carrying out this coöperation will differ considerably according to the location, character and size of the institution, but the same general principles will underlie all methods.

In 1907, The American Museum of Natural History made its first efforts to bring its work into closer touch with the libraries of New York City, and it was felt that the best results would be obtained by working through the juvenile departments of the libraries. Conferences were held with the supervisor of the children's libraries, and several small collections for exhibition in the libraries were prepared. These collections were designed to stimulate the reading of good books relating to the subjects which the specimens illustrated The material was selected with due regard to the general character of the district in which the library was located, and the results in some instances were very striking. An Eskimo exhibit was placed in a branch library on the lower West Side, which has a cosmopolitan population. In less than four weeks the call for Arctic books increased from nothing to four hundred, and to meet the demand the librarian found it necessary to draw on Arctic books from other branches. The results warranted the continuation of this work and for several years it has been carried on in a more or less energetic way. That it has not developed still more rapidly was due in part to the absorption of the Museum's department of education in organizing and carrying out other features of museum extension.

Early in the current year the American Museum was in a position to give more attention to this phase of museum work and the matter of coöperation with the libraries was taken up as a special branch of the Museum's department of public education, all loans being made through this channel. Libraries were visited in order better to understand their needs, and the children's librarians came to the Museum, suggesting the type of exhibit that would appeal to their patrons. From this data, a number of special circulating collections were prepared for use in the children's rooms of the libraries. Each collection was planned to be a unit in itself, to consist of relatively few specimens completely labeled, and to be scientifically accurate as well as interesting.

If you really want a friend to read a book you do not give it to him but *loan* it. Our experience in providing circulating nature study collections for the public schools of New York City had emphasized the importance of making the collections "loan collections," and not leaving them for an indefinite period in the schools. This same idea was applied in connection with the library circulating collections, and it was decided to limit the loan period to four or to six weeks. The results of the year's work have fully justified this decision. During the spring six collections were completed and put in circulation. These were designated as follows: 1 — Springtime Collection; 2 — The Eskimo; 3 — In-

dians of the Plains; 4 — Indians of the Southwest; 5 — New England Birds and Nests, and 6 — Life at the Seashore. In addition to these regularly circulating sets, a few special collections were prepared to meet the needs of certain libraries.

The "Springtime Collection" consists of small habitat groups of the common birds, such as robin, song-sparrow and goldfinch, with nests and eggs, male and female parent birds, and in addition shows peculiar habits of several other birds such as nuthatch and woodpecker. Common insects, batrachians, turtles and snakes are also represented in this collection.

The "Eskimo Collection" consists of thirty-nine pieces which give a fair representation of the life of the Eskimo. The "Indians of the Plains Collection" consists of thirty-eight specimens, including household utensils and articles of dress and emphasizing the decorative art of the Indians as illustrated by their work. The "Indians of the Southwest Collection" consists of forty pieces illustrating the weaving and pottery-making for which these Indians are especially noted.

The collection illustrating life at the seashore comprises sea birds, shells, starfishes, sea-urchins and other marine forms that can readily be found along the seashore, the principal object of interest being a miniature lighthouse, about two feet in height, showing a portion of the headland and beach on which it stands. This collection was first sent to the Fort Washington Branch of the New York Public Library, and the following quotation from a letter of the librarian shows some of the results of coöperation between the museum and one library:

"We used the Museum collection as a basis for the stories used in the work with our older boys' club. Sea stories were told and the ship models explained — rigging, masts, etc. Adult visitors to the room were interested in the exhibit, and a member of the library who had had interesting experiences at sea, talked informally for an hour or so about ships, to a group of about thirty boys. A collection of books on aquatic animals, adventures at sea, sailors' yarns, poems dealing with sea life, were put with the Museum's collection. We had approximately one hundred and seventy circulations from this collection. A bulletin of 'Stories of the Sea' was also posted. Kindergarten classes visiting the children's room with teachers were shown the exhibit in detail."

Although some of the collections were not completed at once and have been in circulation but a short time, they have been seen by more than 30,000 children. The number and variety of similar collections that may be prepared is almost unlimited. It would be comparatively easy to prepare an exhibit illustrating the methods of attracting birds around our homes, such as are described in the many books for bird lovers of which *Wild Bird Guests* by Mr. Ernest Harold Baynes is a good example. Many groups of books on geography and travel could be given added interest through a collection from a natural history museum.

The plans for the development of the work during the present winter contemplate the preparation of additional collections which will be definitely correlated with the special books in the children's libraries and particularly with the story hour conducted by the librarians. Coöperation along these lines is particularly worthy of consideration for there is little doubt that it will produce results of great value to the children.

The exhibits thus far planned have been designed primarily for children. Similar exhibits might well be prepared for adult readers. In connection with a series of books on amateur gardening a collection showing the injurious insects which so often frustrate the ambitions of the tiller of the soil would not only stimulate interest in this group of books but also would convey much profitable information.

Similarly education on problems of public health, as the campaign for the extermination of mosquito and fly, can be materially assisted by small exhibits from the natural history museum, while large numbers of exhibits could be prepared which would visualize and vitalize books on useful arts, fine arts, sociology, geography and travel.

These are only a few of the ways in which practical and effective coöperation may be promulgated between libraries and the museum.

Museum Notes

Daniel Giraud Elliot, noted zoölogist and writer, died on December 22, 1915, at his home in New York City. Dr. Elliot shared with the late Professor Albert S. Bickmore the honor of being one of the two scientific founders of the American Museum of Natural History, and it was through his knowledge, gifts and purchases that the Museum was able to obtain what are now some of its most valuable collections. Dr. Elliot's own collection of birds supplied the Museum with the group of extinct Labrador duck, one of the most valuable bird groups in the Museum, and his extensive travels enabled him to bring to the Museum many other important acquisitions.

Dr. Elliot was the author of many scientific works, a traveler and collector of unusual range and experience, and he will long be remembered as one of the most distinguished naturalists of his time In recognition of his services to the American Museum he was elected a member of the Board of Trustees in November, 1915.

The New York Zoölogical Society is developing in Georgetown, British Guiana, a new zoölogical idea. On January 22, Mr. C. William Beebe, curator of birds in the New York Zoölogical Park, sailed for Demarara to establish there a tropical zoölogical station for the study of the evolution of birds and the life histories of important South American species. Mr. Beebe was accompanied by three assistants, Mr. G. Inness Hartley as research associate; Mr. Paul G. Howes, an expert in micro-photography and the intensive study of invertebrates, and Mr. Donald Carter as collector.

One of the first bird species to be studied exhaustively in its native haunts will be the rather elusive hoatzin, which thus far never has been shown alive in captivity, and which even at this late day is a living challenge to ornithologists. The life histories of the vast majority of tropical birds are yet to be learned, and the new zoölogical station, equipped with expert knowledge and all necessary facilities, will enter and exploit a rich and extensive field.

The Government of British Guiana is offering the new enterprise coöperation, and terminal facilities of great practical value. The Trinidad Steamship Company has joined in promoting the enterprise in many ways. The entire fund for the first year's work of the new Tropical Zoölogical Station has been furnished by five members of the Board of Managers of the New York Zoölogical Society, Messrs. Cleveland H. Dodge, Mortimer L. Schiff, C. Ledyard Blair, James J. Hill, and George J. Gould. Not the least important function of the new station will be the gathering and forwarding of regular supplies of living vertebrates for the New York Zoölogical Park. Arrangements have also been made for collecting reptiles in alcohol for the department of reptiles of the American Museum, for which facilities have been provided well in advance.

Through the interest of the Honorable F. M. B. Fisher, of Wellington, New Zealand, the Museum has been presented by the Minister for Internal Affairs of the New Zealand Government, with two of the five live specimens of *Sphenodon* forming part of the New Zealand exhibit at the Panama-Pacific International Exposition. This almost extinct lizard-like reptile is now found only on certain rocky islets in the Bay of Plenty, Northern New Zealand, and although specimens preserved in alcohol have reached this country in small numbers, no living example has before been seen here, much less studied. Great scientific interest attaches to these seemingly insignificant creatures, owing to the fact that this species (*Sphenodon punctatum*) is the sole surviving representative of the whole order of Prosauria, or primitive reptiles, and is thus practically a "living fossil." The "tuatara" as it is locally called, is now protected by law in New Zealand, having been formerly hunted for food. Models and casts are being made from the living tuataras at the Museum by the section of reptiles, preliminary to the construction of a habitat group.

Since the last issue of the Journal the following persons have become members of the Museum:

Life Members, Mrs. Adolf S. Ladenburg and Messrs. Robert Woods Bliss and Alphonse H. Kursheedt.

Sustaining Members, Mrs. Thomas A. Edison and Hon. Lispenard Stewart.

Annual Members, Mrs. James Brite, Mrs. Morgan Dix, Mrs. T. E. Harden-

BERGH, MRS. W. K. HARRINGTON, MRS. G. J. HELMER, MRS. JEFFERSON HOGAN, MRS. ELON H. HOOKER, MRS. REUBEN HOWES, MRS. ARTHUR B. JEKYLL, MRS. DELANCEY KANE, MRS. ERNEST L. SIMPSON, MRS. DE COST SMITH, MRS. E. W. SPARROW, MRS. JOHN STEMME, MRS. H. GRANT STRAUS, MRS. ALBERT STRAUSS, MRS. HORACE M. SWETLAND, MRS. THEODORE TIEDEMANN, MISSES FLORENCE GAYLEY, MARGARET HOE, and CATHLEEN VANDERBILT, REVEREND ANDREW CHALMERS WILSON, DR. S. A. ELLIS, DR. JOSEPH S. WHEELWRIGHT, DR. R. H. WYLIE, and MESSRS. DAVID A. ANSBACHER, C. L. BAUSHER, RICHARD P. H. DURKEE, FRED. T. FLEITMANN, HENRY S. FLEMING, DUDLEY G. GAUTIER, ROBERT L. GERRY, ROBERT MCM. GILLESPIE, ARTHUR G. HIGGINS, E. S. HUFF, WILLIAM R. INNIS, HENRY JAMES, JR., FREDERICK KUTTROFF, WILLIAM M. LESLIE, ORMOND EUGENE LEWIS, FRED. MULLER-SCHALL, CHARLES H. RUSSELL, HERMAN HUMBOLDT SHULOF, FREDERICK BOULTON SIMPSON, MARTIN STRAUSS, LIONEL SUTRO, NOAH W. TAUSSIG, THOMAS D. VAN DUSEN, ERNST G. VICTOR, C. BLAINE WARNER and A. MURRAY YOUNG.

DR. CLARK WISSLER and DR. ROBERT H. LOWIE were delegates from the American Museum to the Nineteenth International Congress of Americanists, which convened in Washington, December 27–31, 1915. Dr. Lowie also represented the New York Academy of Sciences and Dr. Pliny E. Goddard of the Museum was delegate for the American Ethnological Society. Meetings were held in affiliation with the Section of Anthropology of the Second Pan-American Scientific Congress and with the American Anthropological Society, the American Folk-Lore Society, the American Historical Association and the Archæological Institute of America.

In the Section of Archæology Mr. Charles W. Mead read a paper on "The Puma Motive in Ancient Peruvian Art"; Mr. Alanson Skinner on "Chronological Relations of the Coastal Algonkin Culture"; Mr. N. C. Nelson on "Pueblo Ruins of the Galisteo Basin, New Mexico"; Dr. H. J. Spinden on "Recent Progress in the Study of Maya Art"; and Dr. Clark Wissler, Dr. C. A. Reeds and Mr. Leslie Spier on "Excavations on the Abbott Farm at Trenton, New Jersey." In the Section of Ethnology papers were read by Dr. Clark Wissler on "Comparative Study of Pawnee and Blackfoot Rituals" (by title only); Dr. Herbert J. Spinden on "Origin and Distribution of Agriculture in the New World"; and Professor A. L. Kroeber on "The Pacific Coast Tribes of North America."

ON Thursday evenings during January a course of four lectures on "Varieties of Culture among North American Indians," were given by the department of anthropology of the American Museum. Dr. Robert H. Lowie spoke on "The Indians of the East," and "The Indians of the Plains," and Dr. Pliny E. Goddard on "The Indians of the Southwest," and "The Indians of the Pacific Coast."

A PHASE of the work of the Museum's department of education, which is growing faster than facilities can be provided, is the lecture and demonstration work with the blind children of Manhattan and the Bronx. Since 1910, when it was first inaugurated through the Jonathan Thorne Memorial Fund, this work has been a regular part of the education department's activities, but during 1915 it has been possible to extend and reorganize the facilities afforded. As a result, classes of blind children from the public schools now visit the Museum from ten to fifteen times each month, as against twice a month in 1913. The aim has been to coöperate as perfectly as possible with the schools and teachers in regard to time, subject and treatment, and secondly to have the classes as small as possible so that each child may handle at leisure each specimen or exhibit and may ask questions about it. Talks are given upon a series of subjects, for example: "How our Furred Friends spend the Winter"; "Native Birds and their Nests"; "How Men Travel"; "Cotton, Wool and Silk." Miss Ann E. Thomas, who has charge of this work, makes a point of showing as many natural specimens as possible, in addition to models. Appreciation of the work is so general and practical that twice as many classes are asked for as can be provided with the present equipment.

MR. BARNUM BROWN returned early in January, bringing a carload of fossil dinosaur bones, chiefly from the Belly River Cretaceous formation of Alberta. The collection comprises two complete skeletons; one of the horned dinosaur *Ceratops*, of which the Mu-

seum previously possessed only skulls; the other of the helmeted dinosaur *Stephanosaurus*, not before represented in the Museum's collections. Other notable specimens are a complete skull and jaws of the horned dinosaur *Monoclonius;* a skull and part of the skeleton of an armored dinosaur; and the largest skull yet discovered (five feet in length) of the duck-billed dinosaur, *Trachodon*. Another very rare specimen is a complete lower jaw of a cretaceous marsupial mammal.

In addition to the vertebrate remains, two large silicified tree trunks were secured, over forty feet in length. When these are sectioned it will be possible to determine the genus to which they belong. They are of especial interest because the center of the tree is silicified, while surrounding it the outer portion had carbonized, forming lignite. Several large slabs were also obtained on which impressions of many species of leaves are beautifully preserved. This material will be displayed to show the type of foliage contemporaneous with the dinosaur life of Alberta.

After bringing to completion the Museum's work on the Red Deer River, which has extended over a period of six years and been productive of four and a half carloads of valuable fossils, Mr. Brown went to Northern Montana. Here he secured a large collection from the Upper Cretaceous beds on Milk River. Work was continued in this field until zero weather compelled cessation of operations.

MR. N. C. NELSON returned to New York about the middle of December, having finished the American Museum's archæological investigations in the Rio Grande Valley of northern New Mexico. Mr. Nelson has spent four seasons investigating the territory formerly occupied by the Tanos, which embraces approximately twelve hundred square miles, and in this area has found forty-two true pueblo ruins, composed of from one to forty-three communal houses each, besides innumerable minor sites of archæological interest. These latter consist of small houses, temporary camps, caves, rock shelters, quarries and pictographs. Of the forty-two pueblo ruins found, Mr. Nelson partly excavated the twenty-seven most important, clearing all told something over seventeen hundred ground-floor rooms. He also investigated neighboring territory on the north and on the west, in which were located about twenty-five pueblos. Three of these were tried out by excavation, and a fourth, the historic pueblo of Kotyiti, a natural stronghold in the days of the rebellion, was entirely cleared. Out of these diggings over nine thousand artifacts have been obtained, exclusive of about an equal number of fragmentary objects, immense quantities of broken pottery, animal bones and food stuffs. Not all of the catalogued specimens however, were of such a character as to make their preservation worth while, being made up of mealing stones, hammer stones and similar common objects. Of the three hundred and thirty-five human skeletons exhumed, about seventy-five or eighty were in condition to be kept for study. By excavation in the large stratified refuse heaps belonging to some of the ruins five successive styles of pottery were recognized. With these different styles of ceramics as a key it has been possible to separate the forty-two Tano ruins and about an equal number of ruins in neighboring territory, into five chronological groups. Although this chronological determination does not apply to the entire Pueblo area, it will assist toward an understanding of a large part of it, and marks a real step in the elucidation of Pueblo history.

In the course of the summer Mr. Nelson also made an eight-hundred-mile reconnaissance trip by team and on foot through northwestern New Mexico and adjacent parts of Colorado and Arizona. The journey included the Mesa Verde district, famous for its cliff dwellings; several tributary valleys of the San Juan where many ruins were observed; the remarkable ruins of the Chaco Cañon of which Pueblo Bonito is well known; and finally the ruins of the Zuñi Valley. These four districts were somewhat distinct culture centers in prehistoric times, all but the last mentioned being apparently abandoned by the Pueblo Indians when the Spaniards first came into the country. Many of the picturesque ruins observed are in a fair state of preservation and Mr. Nelson brought back about two hundred and fifty photographs. Fragmentary pottery was gathered everywhere for comparative studies.

THE MEMBERS of the Second Pan-American Scientific Congress and their friends were

tendered a reception and luncheon on Thursday, January 13, by the president, trustees and scientific staff of the American Museum of Natural History. The guests were received in the reptile hall on the second floor, from whence, under escort of members of the Museum staff, they undertook a tour of inspection of South and Central American and other exhibits. The Museum's South American archæological, mineral, and fossil vertebrate collections are especially valuable; its South American study collection of mammals is the largest in the world and its South American study collection of birds the largest in North America.

Among distinguished members of the Congress present were Dr. Ernesto Quesada and Dr. Juan B. Ambrosetti of Argentina; Antonio Carlos Simoens da Silva of Brazil; Le General Légitime, Ex-President of Haiti; Excellentissimo Señor Federico A. Pezet and Dr. Julio Tello, of Peru, and Dr. Aristides Agramonte of Cuba.

A JOINT archæological expedition of the American Museum and the University of Colorado, in charge of Mr. Earl H. Morris of the latter institution, closed its four months' field operations in the San Juan district on December 20, 1915. Mr. Morris spent the early part of the summer assisting Mr. Nelson with his work in the Rio Grande Valley, and in September Mr. Nelson accompanied Mr. Morris to the northern field. Their first joint undertaking was the excavation of a small seven-room cliff house on a branch of Johnson Cañon on the southern border of the Mesa Verde. This cliff house had never before been entered by a white man but the difficult undertaking was not rewarded by any finds of especial importance. Some of the very numerous small-house ruins on the adjacent mesas were tried out with better results. These ruins antedate the cliff dwellings and are often overgrown by large trees, sections of which were taken for the purpose of determining their age.

The main part of the season's work however was devoted to the examination and partial excavation of ruins in tributary valleys of the upper San Juan including the La Plata, Kootch, Carriso, Frances and Gobernador cañons. Several of the worked ruins belong to the earliest Pueblo period, while others toward the east are of a date falling within the time of the Spanish occupation and suggest Zuñi affiliations. A considerable collection of pottery and other specimens were obtained. Mr. Morris is now at the museum of the University of Colorado at Boulder, working over his data.

AN exhibition of paintings by Mr. F. W. Stokes of scenes in the Arctic and Antarctic is now on view in the west assembly hall of the American Museum. On February 13 to 27 an exhibition of bird pictures in water color by Mr. H. C. Denslow will occupy the same hall.

THE American Scenic and Historic Preservation Society held its twenty-first annual meeting on the evening of January 21, in the American Museum of Natural History. The Honorable George W. Perkins, a vice president of the society, and president of the Palisades Inter-State Park Commission, delivered the address of the evening on the progress made in the development of the Inter-State Park and the plans for its future. With funds provided in part by the states of New York and New Jersey but more largely by private generosity, the Commission has purchased the twelve and a half miles of the Palisades between Grant's Tomb and Nyack and has accomplished a great deal toward rendering it a convenient recreation ground. Roads have been built, beaches made, docks, boat houses and restaurants established and in 1915, upwards of a million people crossed the Hudson to walk, camp or picnic, while tenting privileges were enjoyed by twelve to fifteen thousand. Extensive plans for further improvement are in contemplation by the Commission.

AT the Second Pan-American Scientific Congress held in Washington December 27, 1915 to January 8, 1916, Dr. Frank M. Chapman and Dr. Herbert J. Spinden represented the American Museum. Dr. Frank E. Lutz also attended the Congress as delegate of the New York Entomological Society and Dr. P. E. Goddard as delegate of the American Ethnological Society. At a special meeting of the American Association for the Advancement of Science held in connection with the Pan-American Congress, Dr. Frank M. Chapman delivered an address giving an account of the zoölogical survey of South America conducted for the last five years under the auspices of the American Museum.

FOR WIDENING THE INFLUENCE OF THE AMERICAN MUSEUM OF NATURAL HISTORY

To our Readers

The American Museum Journal is a branch of the Museum's work intended to increase and stimulate interest in natural history and to keep its readers in touch with developments in this line. It takes the reader out into every part of the world with great explorers, it contains authoritative and popular articles by the men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. In brief it is a medium for the dissemination of the idea to which the Museum itself is dedicated — namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

In order to promote this idea and extend to a wider circle of readers the opportunities afforded by the American Museum Journal, all those interested in the work of the Museum are invited to write in the space provided below the names and addresses of possible subscribers, to whom we may send sample copies of the magazine.

THE EDITOR

.....191

Editor of the Journal, American Museum of Natural History
77th Street and Central Park West, New York City

I submit the following names and addresses of persons likely to be interested in the American Museum Journal.

Name..... Address.....

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Name.....

The American Museum of Natural History

Seventy-seventh Street and Central Park West, New York City

Open free to the public on every day in the year.

The American Museum of Natural History was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people. It is dependent upon private subscriptions and the fees from members for procuring needed additions to the collections and for carrying on explorations in America and other parts of the world. The membership fees are,

Annual Members	$ 10	Patrons	$1,000
Sustaining Members (annually)	25	Associate Benefactors	10,000
Life Members	100	Associate Founders	25,000
Fellows	500	Benefactors	50,000

Guides for Study of Exhibits are provided on request to members and teachers by the department of public education. Teachers wishing to bring classes should write or telephone the department for an appointment, specifying the collection to be studied. Lectures to classes may also be arranged for. In all cases the best results are obtained with small groups of children.

The Museum Library contains more than 60,000 volumes with a good working collection of publications issued by scientific institutions and societies in this country and abroad. The library is open to the public for reference daily — Sundays and holidays excepted — from 9 A. M. to 5 P. M.

The Technical Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by J. A. Allen, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Publications of the Museum comprise the JOURNAL, edited by Mary Cynthia Dickerson, the *Handbooks*, *Leaflets* and *General Guide*. The following list gives some of the popular publications; complete lists, of both technical and popular publications, may be obtained from the Librarian.

POPULAR PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS. By Clark Wissler, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

INDIANS OF THE SOUTHWEST. By Pliny Earle Goddard, Ph.D. *Paper, 25 cents; cloth, 50 cents.*

ANIMALS OF THE PAST. By Frederic A. Lucas, Sc.D. *Paper, 35 cents.*

ILLUSTRATED GUIDE LEAFLETS

GENERAL GUIDE TO THE COLLECTIONS. New edition issued December, 1914. *Price, 25 cents.*

THE COLLECTION OF MINERALS. By Louis P. Gratacap, A.M. *Price, 5 cents.*

NORTH AMERICAN RUMINANTS. By J. A. Allen, Ph.D. *Pri e, 10 cents.*

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH. By George H. Pepper. *Price, 10 cents.*

PRIMITIVE ART. *Price, 15 ents.*

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